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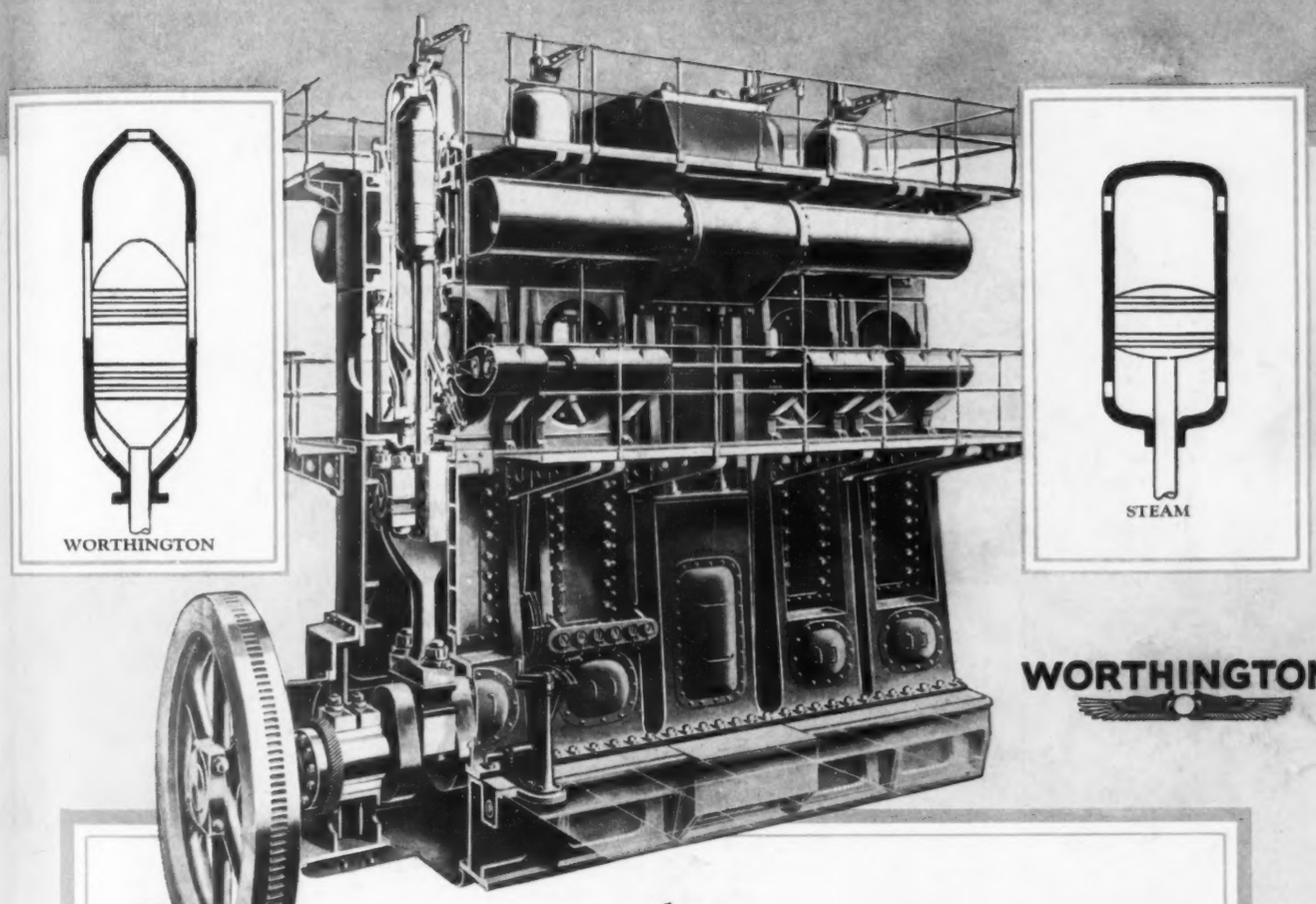

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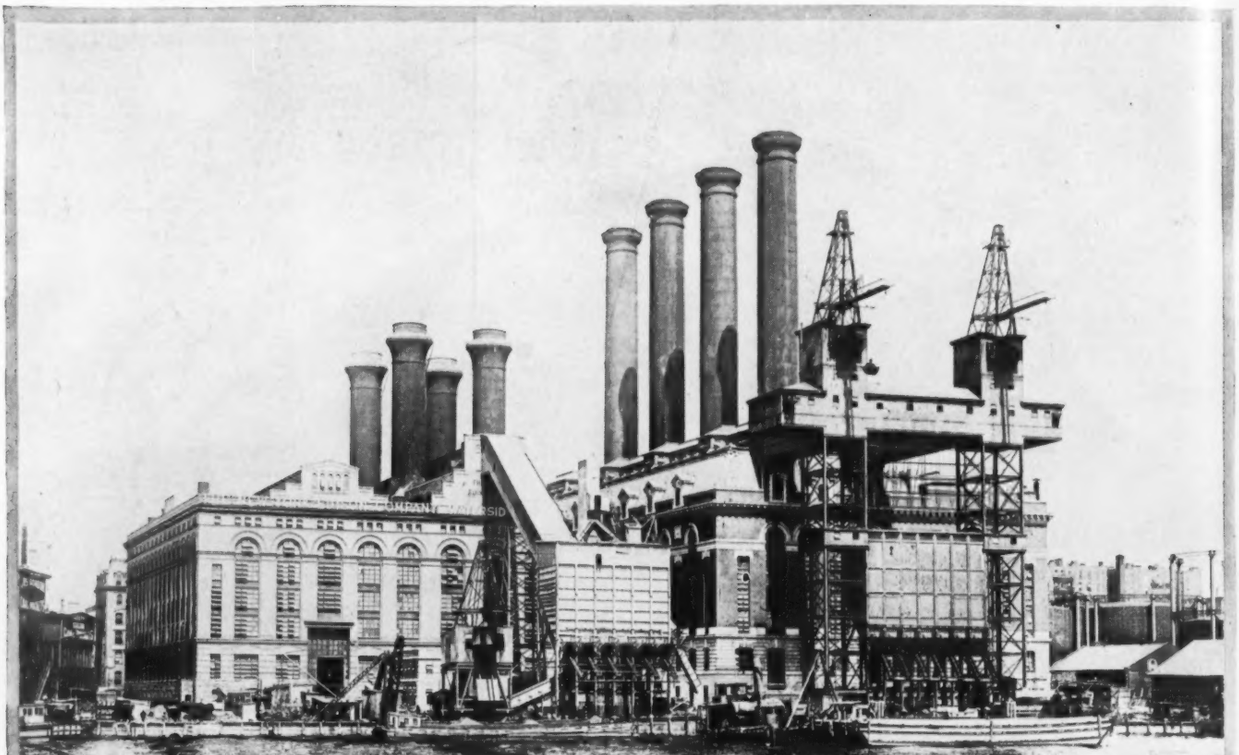

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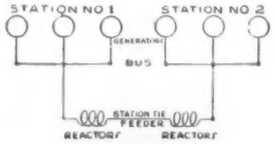

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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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Peace Hath Its Victories

WHEN Napoleon marched on Moscow and the Russians were at their wits' end to ward off his advancing legions, the command went forth to burn Moscow and starve the invaders. The plan was effective, and the Little Corporal was forced to retreat amid privation and hardship which culminated in gigantic disaster. Napoleon and his legions could not contend with nature. When the Southern California Edison Company was brought face to face with lack of water with which to generate electricity for its rapidly increasing load, it made a decision as momentous as that of the Russians. "Tunnel the mountains" was the order given, and when the last charge pierced the High Sierras two weeks ago, engineering skill triumphed over nature, as it has done so often before.

The waters of Florence Lake on the east side of Kaiser Range will now join the waters of Huntington Lake on the west side of the range, 13 miles as the crow flies and 7,000 ft. above sea level. Power houses along Big Creek will intercept the fall of the water and distribute the electricity generated from it over one of the largest electric systems in this country. This engineering feat in bringing increased comfort and prosperity to southern California will add also to the laurels of that far-seeing and progressive corporation, the Southern California Edison Company, and to its undaunted leader, John B. Miller. Deeds like this prove the alertness and resourcefulness of the electrical industry and give proof, if proof be needed, that engineering is not altogether bereft of romance.

Real Values in Interconnection

THE interconnection of utility systems results in a capitalization of diversity, an insurance reserve in generating capacity or a combination of the two. In few cases does it reduce the actual operating costs of producing and transmitting energy. Yet the newspaper-reading public does not understand these facts and is prone to follow those "feature" writers who compose romantic stories about the long-distance transmission of energy from fabulous water powers or mouth-of-mine superplants—stories in which reduction of costs plays a large part.

The real advantages of interconnection are well understood by the men of the electrical industry and are being obtained very rapidly in order to retain the present low power costs in the face of advancing prices for equipment and labor. If two adjacent systems have peak loads occurring at different times, then an interconnection reduces the total generating station capacity required when the systems operate independently. Even if there is no diversity, however, an interconnection permits the systems to operate with a smaller investment in reserve generating capacity and increases the reliability of service. A study of every plan for interconnection is required to give the actual balance sheet, for against the savings in system capacity must be balanced the investment and operating costs involved. In addition to cost elements there are many service and operating features which must have careful consideration before the complete story can be known.

Interconnections in nearly all cases bring to utility managers a financial saving in investment which permits them to retain existing rates in the face of rising prices, but in very few cases result in savings of sufficient magnitude to permit rates to be lowered. Interconnection is an economic move to increase efficiency of investment and reliability of service and should not be construed as offering a panacea to reduce the present cost of producing and distributing energy. The industry and the public will be fortunate if interconnection helps make possible the retention of the present low energy rates in the face of rising equipment, labor and fuel costs.

Record Financing by Electric Light and Power Utilities

BIG sums of money have become things of little note when speaking of developments in the electric light and power industry. Yet it is encouraging and inspiring to find that these utilities have raised $223,625,000 in the first two months of this year, an increase of $89,846,300 over the corresponding period of 1924.

In January stocks, notes and bonds were issued to the amount of $83,400,000, and the ten issues of cumulative 7 per cent preferred stocks predominated. Gold bolds for long terms bore a 4½ per cent interest rate. In February $140,625,000 of new securities was issued. Fifteen issues of gold bonds during this month totaled more than $123,000,000, and the interest rate averaged 5 per cent. Although some refunding occurred, the larger part of the money raised will be used for additions and extensions, and the great increase in capital raised indicates that utility executives look for a large demand for energy in the near future.

Exorbitant Right-of-Way Costs Penalize the Consumer

EXCESSIVE charges for transmission rights-of-way impose burdens in perpetuity upon consumers of electric service. Self-appointed producers of propaganda to exact stiff tribute from utility companies desiring to cross swamp lands of little or no value to farmers seldom admit this fact.

A telling instance of the cost of exorbitant right-of-way charges was recently cited by Samuel Ferguson at a Connecticut legislative hearing. A tie line of great benefit to residents of the middle Connecticut

valley is just going into regular service between the Hartford-Springfield-Turners Falls systems, and on account of "hold-ups" in the two-year job of obtaining rights-of-way it was necessary to change the route of the line from the east to the west bank of the river, adding about ten miles at an excess cost of $120,000 in Connecticut alone. Year after year the citizens will have to pay interest, depreciation, inspection, repairs and energy losses on an utterly unnecessary investment in ten miles of line, for the cost is a part of the project and bears its constitutional right to a fair return upon the investment.

Arguing for an eminent-domain bill which shall do away once and for all with injustices of this sort, Mr. Ferguson properly pointed out that these burdens do not fall upon the stockholder so much as upon the consumer. Central-station managers and those in charge of the development of territorial power and interconnection programs will do well to study costs of this kind with the object of making them clear to the public in the localities concerned. They will do well, too, to back up legislation, when needed, to refer the determination of disputed prices for rights-of-way to the courts.

Lopping Off Branches

DURING his college years a young engineer has practically all of his time and activities laid out for him either by his school faculty or by tradition, environment, personal predilection, etc. But immediately he enters upon a practical career not only is his leisure his own, but even during his working hours much is left to his judgment and discretion. It is here that he begins to resemble a young tree transplanted from a nursery and left to grow without much outside care, merely on the strength of its natural ability to draw the necessary nutriment from the soil and from the air and to convert it into healthful growth. Before long new branches begin to appear, and (in the case of the young man) no gardener is usually on hand to decide which of these should be encouraged to grow and which should be lopped off mercilessly. He has to be his own gardener, unless his employing company provides one, or unless he is fortunate enough to meet some one who will exercise the function to which allusion has just been made.

Any one who has been out of college, say ten or fifteen years, needs a consulting dendrologist, or has to become his own pruning artist, to cut off the branches in his activities and his mode of thought that do not lead anywhere and only waste life-giving sap and prevent it from going to the crown and promoting natural growth.

Especially is an engineer who is changing from purely technical to broader administrative work liable to send out too many branches. He still tries to keep himself posted on the progress of the art in his particular field and to guide his subordinates technically. At the same time he is put on various administrative committees, has to listen to numerous "personal-trouble" stories from members of his staff, must join a Rotary club or the Chamber of Commerce, address school children or boy scouts on patriotic occasions, and what not. So before long he begins to wear that peculiar, strained look of a man who has much more to do than he can possibly attend to. It is here that a real leader is differentiated from an overgrown assistant. A born administrator takes a hatchet, chops off mercilessly the branches that bear no fruit, and in time becomes a beautiful shady tree, a refuge for many men, a joy for others and a source of much superior fruit.

Make Industrial Heating Sales Complete

THERE is no place for guesswork in the study of the economic justification for using electric heat in industrial applications. Electric furnaces have been built a sufficient length of time to be depended upon to produce the results for which they were designed, but the success or failure of an electric furnace in actual operation depends upon more than furnace design itself. It involves equal or greater problems of furnace application, operating limitations and possibilities of improvement through minor changes after installation. The fact that electric furnaces will do what they are intended to do by the original designer does not give the salesman license to lead the prospective customer to expect a "sure cure" for all his operating difficulties when he installs one. Just now there is need for intelligent and intensive study of the economic conditions surrounding the installation of electric furnaces, and to representatives of furnace manufacturers and central-station companies freedom should be allowed in giving every prospective application a thorough economic analysis before making the prospective customer any definite promises. In this connection it is important that the co-operation of the purchaser be gained and that he shall understand that his intelligent study of the furnace after its installation is just as important as the preliminary study made by the designer and the salesman. Frequently minor changes in the equipment after installation and changes in the operating practices may mean the difference between success or failure, although the furnace itself performs exactly as the designer expected it to do. A slight relocation of the heating units, a modification of the draft conditions, a change in the design of the tools used are a few of the things that have had an important bearing upon the success of industrial furnace applications. Electric furnaces are not yet counter merchandise, and their success in actual practice depends more upon the intelligent co-operation of all concerned, both before and after the installation, than upon any other one thing.

To Find the Ideal Refrigerator Motor

AT A RECENT discussion between the principal manufacturers of domestic electric refrigerators and the manufacturers of electric motors it was frankly stated that better motors are needed for refrigeration service. The volume of purchases so far has not influenced the development of a new special standard motor to fit the new condition presented, and the motor manufacturers are naturally desirous of selling standard motors at the standard price—for, as one man said, "any good salesman will try to sell what he has."

If taken literally, however, this is a questionable philosophy. Of course, if volume production is to be achieved, standards must be maintained and special orders discouraged. But the effort of the good salesman will be to discover more and more places where this standard motor may be correctly used, rather

than to attempt to force it into uses to which it is ill adapted. In this case there would appear to be a necessity for a specially designed motor that will provide a generous overload capacity and high efficiency at light load, combined with quiet operation, and all this in greater degree than is now obtainable. The refrigerator manufacturers acknowledge that a promising advance has been made this past year toward a perfect refrigerator motor, and they profess entire willingness to pay more for such motors, feeling that they will be amply repaid through economies in servicing. There is now in prospect a meeting between the motor and refrigerator men in which they will endeavor to establish specifications for the ideal refrigerator motor which may become a new standard.

As David Sarnoff, vice-president of the Radio Corporation of America, recently expressed it, there is a great difference between looking at an opportunity and actually seeing it. The electrical industry has been looking at the market opportunity for domestic refrigeration for a number of years. If the motor manufacturer be not just looking at the opportunity that this development will bring in turn to him, but truly sees it, there will be no difficulty in producing the motor that is needed and at a satisfactory price. A meeting of minds will show the way, just as it has in other fields at other times.

Cable Insulation

DISCUSSION at the recent midwinter convention of the American Institute of Electrical Engineers on the testing of paper-insulated cables indicated a distinct tendency to a better understanding of the relative importance of the various methods of test now commonly in use. For example, there appeared general agreement as to the comparative unimportance of the one-minute continuous-current reading as a measure of insulation resistance and as to the indefinite conclusions to be drawn from power-factor measurements except as indications of very high loss. Attention was focused on the importance of the dielectric strength test, with particular reference to the duration of application. This is sound doctrine, for it is based on recognition of the facts that most cable failures occur as the result of local heating and that this heating arises in dielectric losses immediately dependent on voltage and duration of application.

Thus there was decided question as to the wisdom of the suggestion, made in one of the papers, that both the value and the duration of the dielectric strength test voltage should be increased. It was pointed out that the dielectric losses increase as the square of the voltage, and that therefore increase of both test voltage and time of application are apt to induce local heating far beyond values likely to be met with in normal operation. The more logical practice would seem to be short-time high-voltage tests, to pick up serious weak spots, and long-duration application of a voltage only moderately in excess of rated voltage. Considerable importance was attached also to the measurement of dielectric loss. Here also it would appear that the discussion might have gone further with profit, in recognizing that it is local loss, in each foot say, that counts, and not the total loss. The loss measurement on reel lengths is an average value and may well conceal a high loss at one point. Consequently, the loss measurement would seem to have about the same value as that of power factor; namely, it does not mean much unless it should happen to have an abnormally high value. The ideal test would appear to be the prolonged application of high voltage and a continuous point-by-point study of the temperature throughout the cable length. The additional facilities and time required for such a test would appear to be fully justified, since it would almost certainly pick up all local weak spots.

More Comment on Watts per Square Foot in Home Lighting

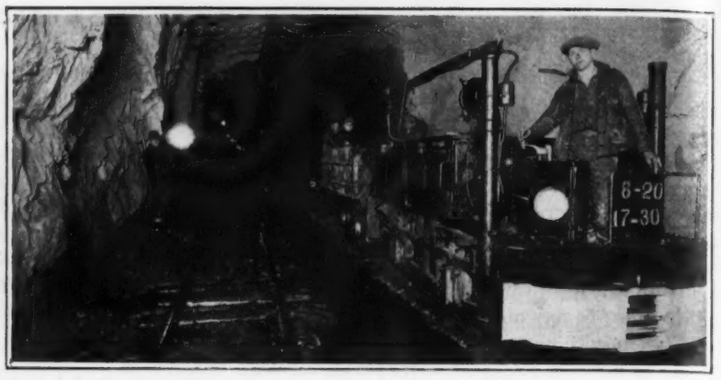
A RECENT editorial in these columns pointed out the difficulties of selling lighting to the householder on a basis of watts per square foot and the inadequacy of such a basis for covering many details of home lighting. That editorial was written from the viewpoint of lighting a home in an esthetic manner as well as for utility. There is another point of view also deserving comment. This viewpoint is an "inside" one and is chiefly that of the central-station company. Obviously the seller of electrical energy would be interested in some means of quickly appraising the standard of lighting in the homes of a district or town or of its residential consumers as a whole. Perhaps watts per square foot would afford such means. Its employment would make it possible for a central station to compare home-lighting conditions in one community with those in another, provided that certain standards as to average total floor area per home were carefully determined.

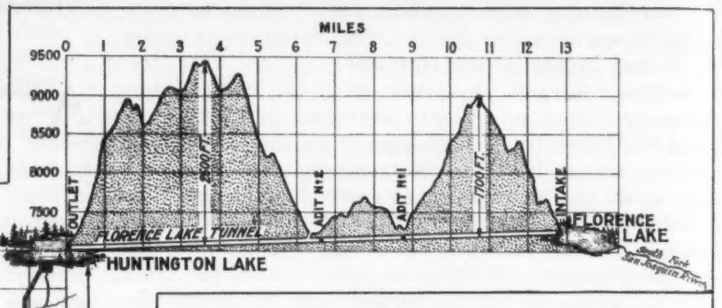
In a report to the National Electric Light Association two years ago M. Luckiesh compared the results of a survey of home lighting with a standard of lighting which he established from the viewpoint of utility. This he termed a "conservative ideal" representing the minimum lighting or wattage of lamps which a home should have if the householder is to enjoy the convenience and utility of artificial light. Decorative lighting was not included, and, obviously, the possibilities in this direction are very great.

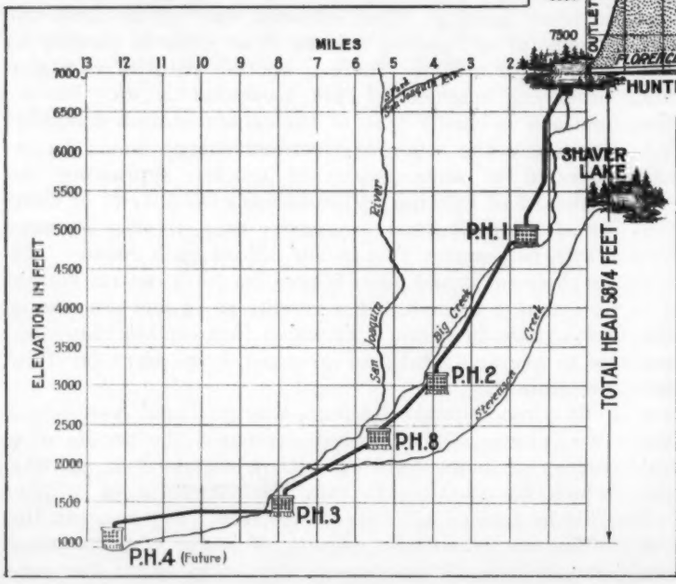
A summary of this "conservative ideal" shows that in the seven rooms and basement considered a total of 1,770 watts in incandescent lamps is necessary, exclusive of halls, porches and so forth. The average home contains about six and one-half rooms. Therefore, revising the figure for the total wattage of lamps in the average home, the value of 1,800 watts may be used. No exact figures are at hand as to the average floor area per home in this country. However, at one watt per square foot the floor area would have to be 1,800 sq.ft. This would be equivalent to two floors, each 30 ft. by 30 ft., which doubtless is larger than the average home if apartments be included. Thus it is found that one watt per square foot of floor area would be a low standard for the home as a whole when compared with the "conservative ideal."

Such a usage of a watts-per-square-foot criterion should be helpful for approximately determining lighting standards and practices in homes as a whole, without bringing up the matter of efficacy or the desirability of applying it to each room in the home. This is another view of the problem which is quite compatible with the views expressed in the editorial referred to.

Florence Lake Tunnel on Big Creek Project







THE Florence Lake tunnel of the Southern California Edison Company is thirteen miles long, 15 ft. x 15 ft. in section and is bored through solid granite under the Kaiser range of the Sierra Nevada Mountains in central California.

The last heading was holed through on Feb. 18, 1925, twenty-two months ahead of the original date set for completion. Water will be carried through the tunnel from the Florence Lake reservoir to Huntington Lake, the existing storage reservoir for the chain of power plants on Big Creek and the San Joaquin River. The total cost of the tunnel, including roads, interest, overhead, etc., is said to be $17,000,000.

Upper left—Eleven per cent of the tunnel required a concrete lining.

Upper right—Storage-battery locomotive hauling a muck train in the tunnel.

In center—The Southern California Edison Company Big Creek-San Joaquin power project.

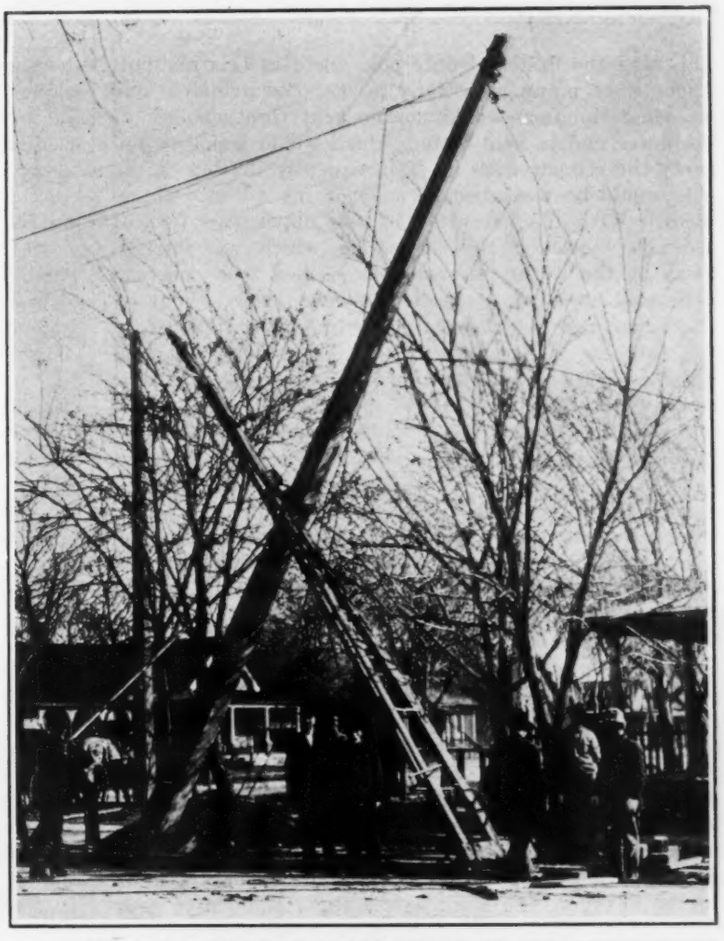
At bottom—Florence Lake reservoir site.

Experience with Concrete Poles

Oklahoma Company Started in 1906 to Use This Kind of Support for Its Transmission Lines—Various Types and Methods of Construction Tried and Tested—Problems Involved—Cost Data—Present Opinions

By J. M. BROWN
Superintendent Electrical Department, Oklahoma Gas & Electric Company, Oklahoma City

EVERY distribution engineer encounters difficulties in placing poles on streets in cities even with the best-appearing pole possible and is frequently required to put up more expensive and permanent construction than wooden-pole line affords. Up to 1906 the experience of the Oklahoma Gas & Electric Company with Western red-cedar poles was such that it questioned whether their use should be continued, first because of the relatively short life of wooden poles and, second, because of the small ground-line diameter then obtained, which was considered objectionable for city distribution work. However, the Western red-cedar pole did present a much better apearance than the Northern white-cedar poles then obtainable. Furthermore, considerable delay was experienced in 1906 in securing cedar poles, particularly Northern white-cedar poles, which were at that time believed to be the only pole which it was practical to use in this vicinity. What Northern white-cedar poles were obtained then were of such a nature that they did not present a very pleasing appearance to the public and sometimes called forth caustic remarks when they were placed in front of residences or business houses. Consequently the company considered experimenting with concrete as a substitute for wooden poles.



DOUBLE-GEARED HAND WINCH AND FRAME USED IN ERECTING CONCRETE POLES

Several types of concrete poles—octagonal, hollow, reinforced hexagonal, hollow, reinforced; bridged construction for heavy feeders, and solid square poles were made in the order named with intervals between for examining construction, transportation, erection and attachment problems through actual service. Cost data were also collected and extensive tests made. While results were eventually obtained which were very satisfactory, the Oklahoma Gas & Electric Company has not made concrete poles since the war began in 1914, as materials and labor have made it uneconomical to install them in view of the price at which satisfactory cedar poles of good appearance can now be obtained. Several thousand concrete poles made and installed between 1906 and the beginning of the war are still being used, but wooden poles are considered more economical to install on all except the main feeder lines. These are at present still being built with concrete poles.

Some of the experiences with concrete poles may be of interest to other utility companies which are now considering their use or expect some day to use them.

The first experience was in making an octagon-shaped wooden form. An octagon shape was adopted in order to allow flat surfaces on the pole at various angles which would provide a good bearing surface for attachments to the pole and also to eliminate as much weight as possible. The poles were also made hollow. A core was made of pipe of such size as to allow two inches of concrete across the flat section of the octagon, and the pole was reinforced with eight No. 8 galvanized-iron wires, around which were placed bands of No. 8 iron wire. These bands were spaced 12 in. apart, and the reinforcing wires were attached thereto with fence clips so that when the reinforcing was completed it was of conical shape, having the same taper as the pole. This reinforcing was centered in the form, allowing a 2-in. wall of concrete on all faces, measured perpendicular to the flat section of the octagon. In order to fill this form it had to be placed in a vertical position.

FORMS USED IN MAKING CONCRETE POLES

A—Form for making hexagonal hollow concrete pole. B—Completed hexagonal hollow concrete pole with stressed reinforcing. C—Form used in making solid square concrete poles.

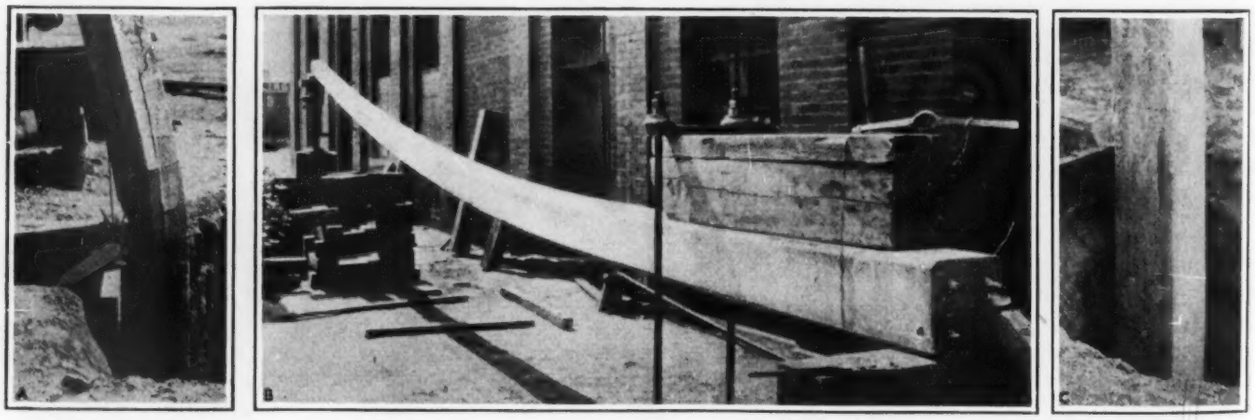
This was the first and only pole made in this manner. There were many objections to it. The principal one was that the form could not be kept tight enough at the lower end to hold water, which would leak out and carry the cement with it. Consequently the top of the pole would be weakened because of the absence of cement. With the exception of the upper two feet of the pole, however, the cement in which was carried away by the water, the concrete seemed to be perfect.

Several important objections were brought out in this experiment which would have to be overcome before the concrete pole could be a success. The first and principal objection, much to the surprise of the company, was the extreme flexibility of the pole. This was considered very objectionable as the concrete would be damaged in handling and the life of the pole thereby decreased. It was evident that the pole was not sufficiently reinforced. However, the first pole was placed in service on the distribution lines, where it remained until 1912, when it was removed and broken up to determine the condition of the reinforcing. It was found to be in excellent condition. This convinced us that the deterioration of reinforcing steel in the concrete pole is not serious.

Using the experience thus gained, an attempt was made to improve the method of constructing concrete poles. It was decided to make the next pole hexagonal in shape because the octagon-shaped form was difficult to construct and maintain, there being so many small tapering pieces required. The hexagonal-shaped form was made in two V-shaped halves which when placed on a 2-in. x 12-in. plank would form five sides of the hexagon, the sixth side being left open to pour the concrete. On every side of the form wedges were employed to key the V-shaped halves securely against the 2-in. x 12-in. plank. Adjustable screw clamps were used to hold the form down tightly on the plank or form base.

After completing this form a question arose regarding the reinforcing to be used. It was decided to employ twelve ¼-in. high-carbon steel deformed bars equally spaced in the concrete wall of the pole. The form was designed to make a 35-ft. pole 16 in. in diameter at the butt and 7 in. in diameter at the top measured across the flat face of the hexagon. As the pole was designed to be hollow, a conical-shaped core was made of galvanized iron 9 in. in diameter at the larger end and 2 in. in diameter at the smaller end. The first core was made at first in one section, but later in two sections, because it was found difficult to pull the core longitudinally. The two sections were made so as to allow the smaller section to telescope into the larger one. In deciding on the use of ¼-in. reinforcing steel the company had in mind minimizing the weight of the pole as well as giving it strength.

The advisability of subjecting the reinforcing steel to tension until after the concrete had set was considered, and cast-iron plates were made for each end of the form, between which the reinforcing was stretched. The reinforcing bars were run through holes in the plate at the smaller end about 2 in. to 4 in. and bent sharply at right angles. The reinforcing steel being high-carbon, one can realize that it would take a tremendous pull to straighten this right-angle bend; in fact, it will break. The other ends of the reinforcing bars were run through holes in the cast-iron plate at

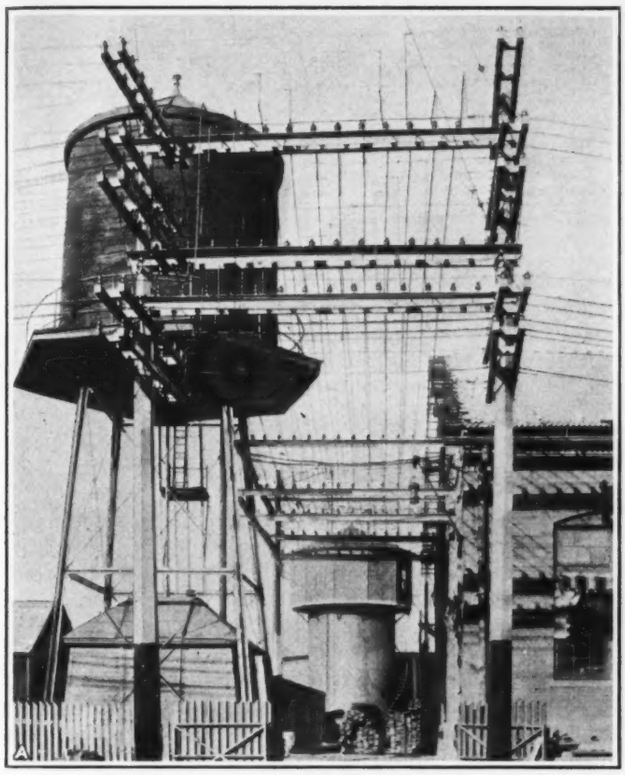


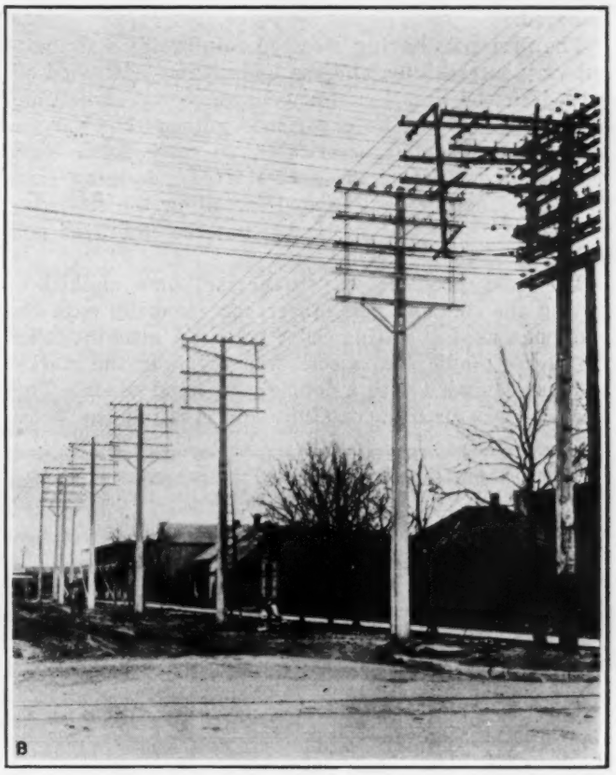
TEST METHODS AND RESULTS FOR CONCRETE POLES

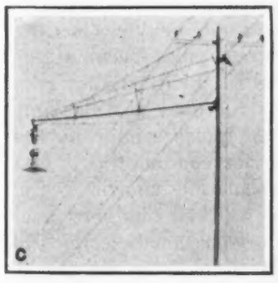
A—Hexagonal hollow reinforced-concrete pole after subjecting to test to destruction. It has a 7-in. top, 16-in. butt, and contains twelve ¼-in. bars. With applied load of 878 lb. transverse to pole at 28 ft. 6 in. from ground, deflection was 61 in. at time of rupture (see table). B and C—Solid square pole subjected to bending stress. (B) With pull of 2,180 lb. deflection was 53 in. Contained ¾-in. reinforcing steel. (C) Ruptured at pull of 2,202 lb.; deflection somewhat over 41 in.

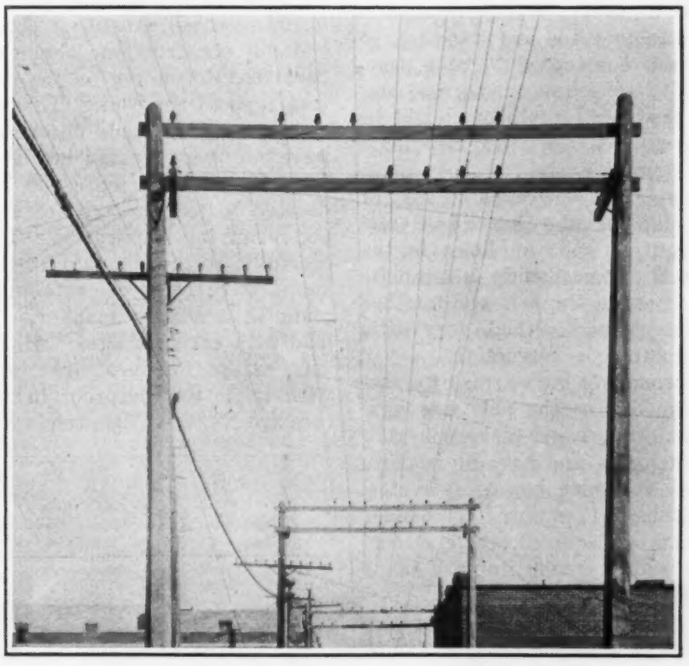
the larger end of the form, special and case-hardened eye bolts were slipped over the ends of the bars, and these ends were bent around the eye bolts enough to allow a short section of pipe to slip over the bent end of the reinforcing rod. This done, a washer was placed over the threaded end of the eye bolt and against the end of the pipe and a nut screwed up tight on the eye bolt. By so doing the reinforcing bars were brought to sufficient tension to support them in their proper positions in the pole without any central supports. This required a tension of about 1,100 lb. per bar.

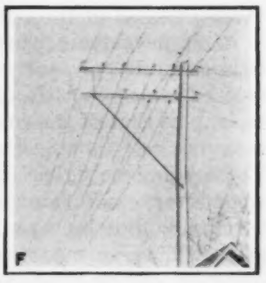
A one-to-two-to-three concrete mixture was used, being poured very wet—in fact, wet enough to run into place without tamping. This was found desirable in order

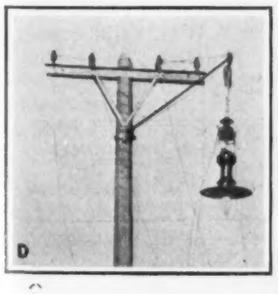


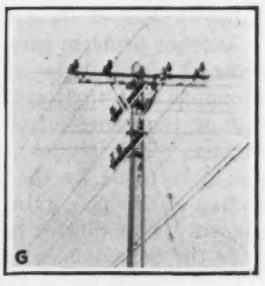












INSTALLATION PRACTICES USING CONCRETE POLES

A—Heavy feeders from power house supported on angles attached to concrete poles. All except fourteen conductors are No. 3/0; the remainder are No. 6.

B—Heavy feeder line under construction using square solid concrete poles.

C—Street-lamp mast arm on one of the first-built concrete poles.

D—Straight uniform poles without guys appeal to public. Note mast-arm construction for the street-lamp support. For attaching the mast arm a clamp collar was made in two halves to clamp to the pole, and the mast arm was attached to this collar. The rods supporting the outer end of the mast arm were supported by the steel cross-arm by drilling holes through the arm near the brace bolts.

E—Bridged-alley construction using concrete poles.

F—Side-arm construction found practicable with concrete poles.

G—Galvanized cross-arms on concrete poles.

not to disturb the alignment of the reinforcing bars, as it was very important that they be centered in the walls of the pole, which were made as thin as possible to keep down the weight. About four hours after the form was filled the core was pulled out just enough to free it, and about eight hours later it was entirely removed. The pole was allowed to set three days before the tension was released on the bars and the form removed.

The first pole having stressed reinforcing rods came out very successfully, and the undesirable flexibility observed in the first concrete pole made was practically eliminated. With the experience gained thus far the pole was considered practicable, so more forms were made and manufacturing was started. Judging from the experience in hauling and installing the first concrete pole, there was no doubt that the improved pole should be handled likewise.

The next problem was to devise some method of setting the concrete pole other than manually with the pike poles used in setting cedar poles. A machine called the "little giant pole raiser" was found in the market and was equipped with a double-gear hand winch. This machine was used successfully for erecting the poles.

TABLE I—ACTUAL QUANTITIES OF MATERIAL AND LABOR REQUIRED TO MAKE ONE 35-FT. HOLLOW HEXAGONAL CONCRETE POLE

Seven inches in diameter at the top and 16 in. diameter at the butt measured across the flat section of the hexagon.

Water, 429 lb.; 51 gal.; at 10 cents per 1,000 gal.		$0.005
Rock, ¾-in.; 15 cu.ft., ⅝ cu.yd., at	$2.455	1.364
Sand, 10 cu.ft., 10/27 cu.yd., at	0.25	0.092
Cement, 5 cu.ft., at	0.38½	1.925
Reinforcing steel, twelve bars 36 ft. long—432 ft.—108 lb. at	0.028	3.024
Total cost of material		$6.410
Labor, 3 hours 45 minutes, at 31¼ cents per hour		$1.17
Total		$ .58

Enough poles were then made to construct 2 miles of line, which was completed in 1907. With one or two exceptions, all of the poles in this line are standing.

After developing what was considered to be a practical concrete pole, the use of steel cross-arms was considered, since the life of the pole equipment should be as long as that of the concrete pole. A galvanized angle measuring 2½ in. x 3 in. x ¼ in. was used for cross-arms. There being no "give" to steel or concrete like that of wood, very accurate boring of the brace-bolt and through-bolt holes was required and the holes in the poles had to be made exact. Consequently a template was used for molding the holes in the pole and another for drilling the steel arms. Thus fortified, very little difficulty was encountered during construction.

Another problem arose in placing buck-arms or cross-arms at right angles to the line as the pole was hexagonal in section; the cross-arms would make pole contact on the corner of the hexagon and have no bearing surface. This trouble was overcome by using a steel pole gain made by the Hubbard Company. The inner section of this pole gain, as manufactured, was crescent-shaped to fit a wooden pole, so it was bent into a V shape to fit the hexagonal corner of the pole.

It was found necessary to make special poles for corners where cross-arms were to be used at right angles in order to eliminate hand drilling on the job.

After the first line of concrete poles was successfully constructed in 1907, the concrete pole so used was adopted for various other uses, and its manufacture increased. One of the uses for which the concrete pole

TABLE II—YARD OPERATING COST PER MONTH

Seventy-four poles made in thirty days.

80 bbl. cement, at	$1.54	$123.20
24 yd. sand, at	0.40	9.60
37 yd., ¾ in. rock, at	2.45	90.65
2½ tons ¼ in. reinforcing steel, at	56.00	140.00
128.13 gal. water, at per 1,000 gal.	0.10	1.28
43 kw.-hr. to operate mixer, per kw.-hr	0.05	2.15
Total cost of material		$366.88
Labor: 1073½ hours, at	$0.31¼	$236.56
236 hours, at	0.25	66.00
179 hours, at	0.34⅜	67.75
123 hours, at	0.45	55.28
Total labor		$425.59
Total cost labor and material		$792.47
Total labor cost to maintain forms		55.28
Total cost		$847.75
Cost per pole:		
Labor and material		$10.71
Form repair		0.747
otal actual cost per pole		$11.457

was adopted was for street-lighting circuits and street-lamp supports. It was found that the concrete pole, as manufactured at this time, had sufficient strength to withstand a side pull of two No. 6 wires when pulled moderately tight without guying or causing any bending movement in the pole. Since street-lighting circuits have to be placed on the streets, this one feature made the concrete pole very favorable from the public viewpoint, because it presented a much more pleasing appearance than the wooden pole and eliminated many of the guys and anchors which are not only unsightly but to some extent hazardous. Not only was the concrete pole adaptable for mast-arm construction, with many advantages, but it was used very successfully for span-wire construction where this was demanded or where mast-arm construction was not desirable. In every distribution system there are places where side-arm construction is necessary, and such was the case with this work in various places. Concrete poles can be used for this purpose as well as wood and are very much more permanent.

Some construction which required heavier loading than that depending on the concrete poles became necessary about this time. This was for bridged-alley construction. The loads on these structures at this time were not very heavy, but as the poles would in the near future carry more and heavier conductors, it was decided to use the type of construction shown in the accompanying illustration. This worked out very successfully, so the company considered reconstructing the supports carrying all outgoing feeders from its power plant in a similar manner. These, too, carried their load with entire success. All wires through the bridgeway, except fourteen, are No. 3/0 A.W.G. solid copper with triple weatherproof braid. The fourteen conductors are No. 6 A.W.G., triple weatherproof braid.

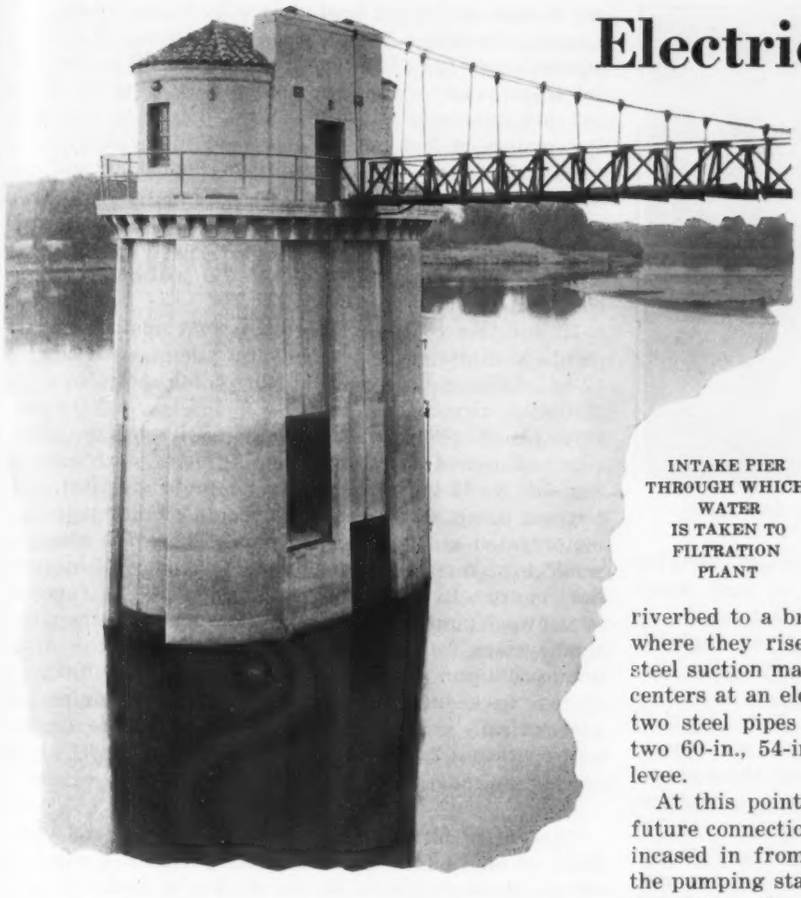
TABLE III—STRENGTH TESTS ON HOLLOW HEXAGONAL CONCRETE POLE

Style 16 in. butt, 7 in. top, hexagon; calculated breaking load at top; reinforcing rods, 12½ in. sw. deformed; weight (actual), 2,200 lb.

Pull Applied (Lb.)	Corresponding Deflection (In.)	Permanent Set (In.)	Remarks
620	11¾	...	Hair cracks from ground line to 6 ft. above ground line.
728	16	...	
748	18	...	Twenty cracks from ground line to 8 ft. above. One crack at ground line.
798	41	...	¼ in. balance of twenty cracks from size of hair crack to 1/16 in. Concrete crushing at ground line on opposite side from a crack ¼ in., followed by a total rupture after a time of five minutes.
All strain relieved	...	28½	
878	61	...	
	Deflection increasing during time of five minutes until it reached 70 in., then broke.		

Electricity and Water Filtration

By H. H. DUNN
Berkeley, Cal.



INTAKE PIER THROUGH WHICH WATER IS TAKEN TO FILTRATION PLANT

Municipal Filtration Plant of Sacramento Incorporates Latest Engineering Principles—Station Built in Halves to Operate Together or Separately.

THE construction, installation and operation of the ultimate 80,000,000-gal.-per-day filtration plant erected by the city of Sacramento, Cal., brings out some very interesting features. Normally 48,000,000 gal. of water is taken daily from the Sacramento River, purified and distributed to the city users of water for domestic and industrial purposes. The plant is so designed that further installation of pumps and motors will handle a maximum of 80,000,000 gal. daily.

A feature of the plant is that one operator is all that is required. All controls terminate on one switchboard, and the plant is constructed in separate and distinct halves so that either half can be operated independently, both tied together or both operated separately. The water supply of the filtration plant comprises an intake pier in the Sacramento River, one-quarter of a mile below the confluence of that river with the American River. Two siphon conduits from this intake pier lead easterly to the pumping station, about 1,000 ft. distant. The intake pier is a huge hollow column constructed of concrete, with the interior divided into two halves, set out in the river to receive the water through five 4-ft. x 6-ft. rectangular hand-operated sluicegates, set into the walls of the pier, two on the northern half and three for the southern half, with a similar interconnecting gate between halves.

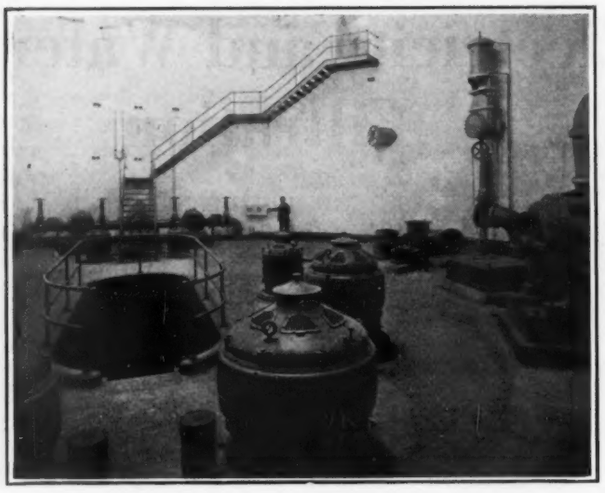
The pier is founded on the gravel bottom of the riverbed at an elevation of 44 ft. below low water, while the gate-opening platform is at an elevation of 38 ft. above low water, giving a pier height of 82 ft., not including housing of the gate-operating stands, with intervals at an elevation of 14 ft. below low water. There are two concrete conduits each 5 ft. in diameter, laid side by side below the riverbed to a bridge pier on the bank 145 ft. eastward, where they rise vertically and connect to two riveted steel suction mains, each 5 ft. in diameter, laid with their centers at an elevation of 7 ft. above low water. These two steel pipes pass through the levee and connect to two 60-in., 54-in., 42-in. Y-branches located inside the levee.

At this point the 54-in. connections are flanged for future connection, and the two 42-in. riveted steel lines, incased in from 4 in. to 6 in. of concrete, are laid to the pumping station. At a point 75 ft. from the pumping station there are two 42-in., 54-in., 60-in. Y-branches, laid in the opposite direction, with the 54-in. connections blank-flanged. At the pumping station the center line of the conduits is 8 ft. above low water, showing a one-foot rise in gradient from the bridge pier. From the Y-branches two 60-in. riveted steel lines incased in concrete are laid easterly under the pumping station, where they drop down to an elevation of 17 ft. below low water.

It will be seen from the above that whenever the river level is in the vicinity of 8 ft. above low water the water will flow through the intake conduits by gravity, and when the river is below 6.25 ft. elevation the intake will act as a siphon. To insure siphonic action and to maintain the requisite vacuum, there are installed in the pumping station two vacuum pumps, each of 40 cu.ft. free-air capacity, one being driven by a variable-speed motor and the other by a constant-speed motor, and both operated by automatic vacuum regulator starters. The suction lines of these pipes are connected to three siphon vacuum domes on each intake conduit, two on each line at the bridge pier on the river bank and one on each line at the west wall of the pumping station.

PUMPING EQUIPMENT INSTALLED IN THE SACRAMENTO MUNICIPAL PLANT

Primarily, the pumping station consists of a concrete caisson 75 ft. in diameter, in which all pumping equipment and switchboard are installed. Over this is constructed a rectangular concrete structure, 79 ft. x 128 ft., in which are housed transformers, bus structures, control equipment, administration offices, machine



LOW-LIFT PUMP MOTORS ON MAIN OPERATION FLOOR

shops and store and locker rooms. The main pumping equipment consists of low-lift pumps, to take water from the river and pump it to a sufficient height to carry it through the filtration system, and high-lift pumps, which pump the filtered water into the distributing system.

The low-lift pumps consist of two 20-in. vertical centrifugal pumps operating at 14,000 gal. per minute at a 45-ft. head, driven by 225-hp. vertical three-phase, 60-cycle, 580-r.p.m., 2,200-volt, squirrel-cage induction motors; two 18-in. vertical pumps operating at 10,500 gal. per minute, driven by 175-hp. vertical three-phase, 60-cycle, 690-r.p.m., 2,200-volt, squirrel-cage motors, and one 18-in. vertical pump operating at 7,000 gal. per minute, driven by a similar 125-hp., 690-r.p.m. vertical motor.

The present pumping installation has a capacity of 80,000,000 gal. per day in low-lift pumps, but provision has been made to allow for the installation in the future of eight 25,000,000-gal.-per-day pumping units, equivalent to 200,000,000 gal. daily low-lift pumping capacity. The low-lift pumps are all set on the lower pump floor, with their bases on floor at elevation minus 6.5 ft., while the motors driving these pumps are set on the main floor of the pump chamber at an elevation of about 8 ft.

The high-lift pumps consist of three 20-in. horizontal single-stage centrifugal pumps operating at 14,000 gal. per minute at 185-ft. head, driven by three 900-hp. horizontal three-phase, 60-cycle, 900-r.p.m., 2,200-volt, squirrel-cage induction motors, and two 20-in. horizontal single-stage centrifugal pumps operating at 10,500 gal. per minute, at the same head, driven by two similar motors of 700 hp. The present high-lift pumping installation thus has a capacity of 90,000,000 gal. per day, but, as in the case of the low-lift pump battery, provision has been made for the installation of eight units having a capacity of 25,000,000 gal. per day. All the high-lift pumps are set on the main floor at an elevation of about 8 ft.

LOW-LIFT PUMPS IN SACRAMENTO FILTRATION PLANT

In addition to these, there are four main auxiliary pumps, comprising two wash-water pumps, each being a 12-in., 4,000 gal.-per-minute horizontal centrifugal installation directly connected to a 100-hp., 1,200-r.p.m., three-phase, 60-cycle, 2,200-volt, squirrel-cage induction motor, and two drain-pumping units, each consisting of a 12-in., 4,000-gal.-per-minute vertical centrifugal pump, directly connected to a similar induction motor rated at 50 hp., 900 r.p.m. There are also two small 4-in. vertical sump pumps, driven by 7½-hp. vertical motors, to drain the station sump. The function of the wash pumps is to furnish clear water to the filtration system for washing the filters, while the drain pumps will pump sediment and sand from the filtration system back into the river. These four pumps are automatically controlled by gage-type pressure regulators operating 2,200-volt automatic controllers.

CENTERED CONTROL

The entire filtration is under the control and operation of one man. To accomplish this, the control of all the electric circuits of the station is centered on a ten-panel remote-control switchboard arranged in an arc and standing on a dais 21 in. above the main pump floor. From this benchboard all power circuits, transformer circuits and high-lift and low-lift pumps are controlled. On the sub-base of the benchboard are mounted handwheels, which are connected to four-way valves in the rear of the board, controlling hydraulic valves on the suction of the low-lift pumps and on the discharge of the high-lift pumps, thus controlling all outgoing raw water from the station and all incoming filtered water to the station.

On the left of this benchboard are three vertical slate panels controlling station 220-volt and 120-volt power and lighting circuits. At the right of the benchboard are five vertical cast-iron hydraulic-gage panels, carrying hydraulic gages giving complete indications of heights of water in filtration tanks, sedimentation bases, rates of flow and pressure on the city mains, as well as total records on filtered water pumped, as given by type M Venturi meters. The control of the high-tension oil circuit breakers is accomplished from the benchboard by the aid of eighty-cell, 112.5-amp.-hr. storage batteries, which are charged automatically by a 4.5-kw., 125-volt motor-generator set.

POWER FROM TWO SOURCES

The transformer and switch room containing all the oil circuit breakers controlled from the benchboard is west of the main pump room at an elevation of 24 ft. Since the station is arranged electrically in duplicate halves, it has been decided that the city shall buy power from both of the two large companies serving this territory and divide the load between them. Each company has installed two No. 4 11,000-volt cables from

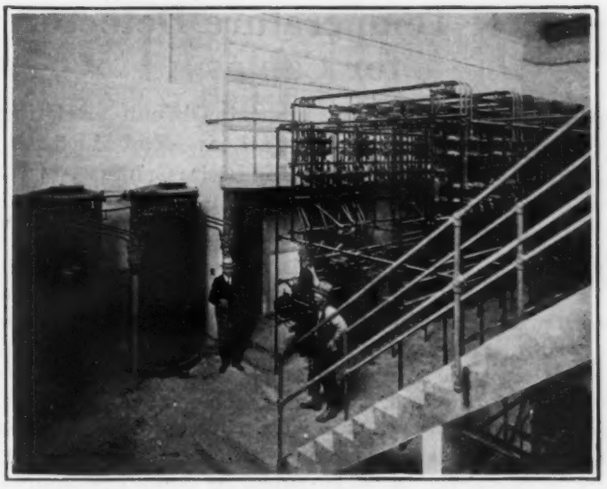
their respective power sources to the 11,900-volt double-bus structure in the station switch room. A bus-tie oil circuit breaker has been installed to tie the buses together, and this is electrically interlocked with the power company breakers, so that the bus-tie breaker cannot be closed when both power company breakers are closed, but can be closed when either of these is open. From this 11,000-volt structure taps are taken by No. 0 lead-covered, varnished-cambric cables to two banks of transformers, each bank consisting of three 500-kva., 11,000/2,300/1,150-volt, oil-insulated, self-cooled transformers.

Provision for Future

In the high-tension structure provision is made for two future banks of transformers of similar size as well as all conduits and control circuits for them. The starting bus for all pump motors is taken directly from the middle taps of the transformers. From the transformer banks the power is taken in three 400,000-circ.-mil varnished-cambric, lead-covered cables to the low-tension bus structure, upon which are mounted the 1,100-volt and the 2,200-volt starting and running buses for pump-motor circuits. This bus structure, includ- all bus and disconnecting switches, is installed for the ultimate development of the station. Circuits are so arranged in the transformer and switch room that it is possible to operate on both power companies simultaneously, or on either one, using the other as a stand-by, and either half of the station can be operated on either company, making an equal load distribution possible under all operating conditions.

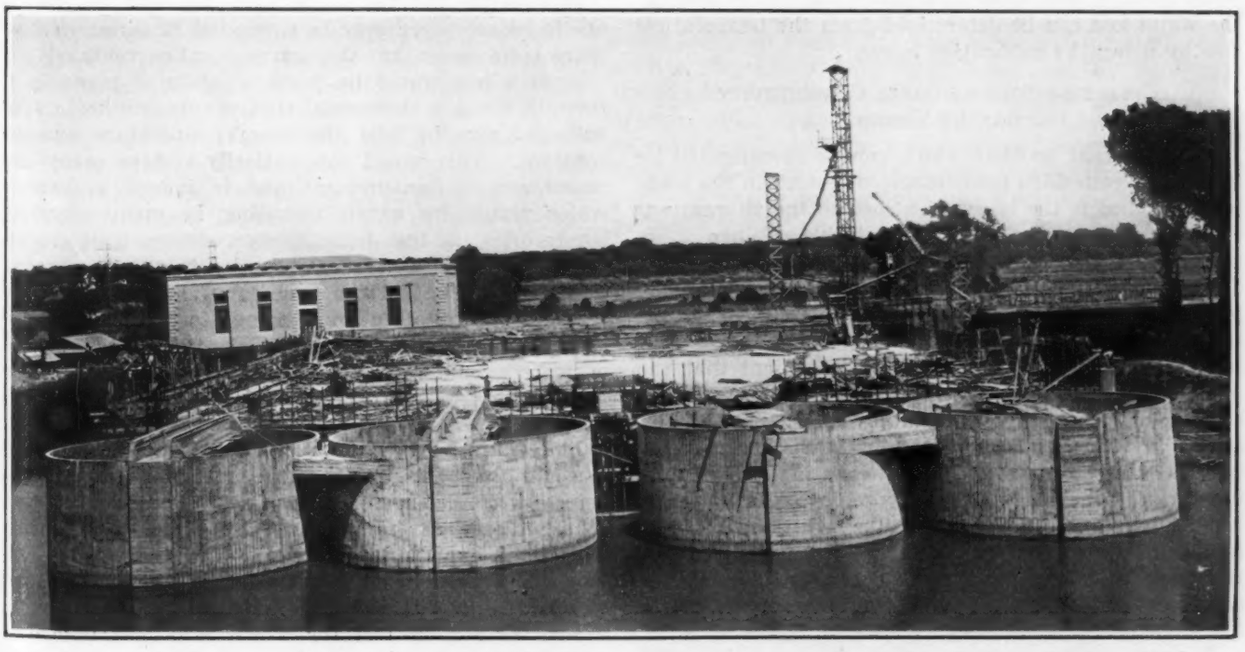
Lighting Plan

The main pump floor is lighted by the use of twelve elliptical reflectors placed under the walk at an elevation of 40 ft. and set at 30 deg., each containing a 300-watt bowl-frosted type C lamp. Between the roof trusses at an elevation of 62 ft. there are auxiliary 300-watt bowl-frosted type C lamps in "RLM" dome reflectors. Over the transformer room and bus structures eight Benjamin fluted-bowl reflectors carrying 500-watt bowl-frosted type C lamps are used. For lighting in the low-lift pump room and the general small wall lighting Benjamin marine wall fixtures have been installed. In case of power failure a pair of automatic switches on the sub-base of the battery-charging panel will automatically throw over the station passage lamps, switchboard lamps and enough lamps to permit disconnecting switching in the transformer room from the alternating-current circuit to the storage-battery circuit.



BUS STRUCTURE USED IN SACRAMENTO FILTRATION PLANT

Material, motors, pumps, piping or any other machinery or fixtures can be handled easily throughout the building by a 10-ton three-motor traveling crane, which spans the width of the building. It is easily operated and one man can handle it in case of emergency. The pumping station is connected with the public telephone system and has its own interphone system between pumping station, water tower, tanks and distributing stations in the city. Connection with the two power companies and with the city fire and police stations has also been installed.



COAGULATION TANKS, SEDIMENTATION BASES AND PUMPING STATION

Use of Temperature Detector for Cables

Alternating-Current Measurements Difficult—Relation of Conductivity to Watts Loss—Embedded Thermocouples on Composite Cables

BY H. B. DWIGHT
Canadian Westinghouse Company, Hamilton, Canada

THE measurement of the alternating-current conductivity of large conductors is not easy to make with precision. The voltage drop in any ordinary length of cable is so low compared with the heavy current rating of such a cable that special laboratory instruments are required. Ordinary commercial meters or precision meters used with current transformers do not give the results required in such a test. Accordingly the conductivity of large cables is usually measured with direct current, for which there are commercial meters that can give precise results under the special conditions described. But a direct-current measurement cannot give an answer to questions such as the effect of steel cores or of irregular alternating-current distribution over the section of the cable, and so another method of measurement, simple enough to be within the capacity of a commercial test department, is recommended in this article.

The conductivity of a cable is directly connected with the watts loss per foot, and hence with the temperature rise of the cable under steady load conditions. The temperature rise can be measured with great accuracy by means of modern embedded temperature detectors, such as temperature resistance coils or thermocouples, as used in large alternating-current generators. The watts can be accurately and easily measured when direct current is flowing, as stated in the preceding paragraph.

It is proposed in this article to calibrate test samples of cables by plotting for each sample a curve of final temperature rise against watts loss, direct current being used. Then, when alternating current is flowing, the watts loss can be determined from the temperature rise by using the calibration curve.

EFFECT OF CORE ON CABLE CONDUCTIVITY CAN BE FOUND

An important problem which can be investigated by the use of embedded temperature detectors in the manner described is the effect of a core on the alternating-current conductivity of a large cable. When it is remembered that 2,000,000-circ.mil copper cables, such as are manufactured for underground cables, have 30 per cent increase in resistance due to "skin effect" at 60 cycles, and that this can be reduced to 10 per cent by putting a core in the cable, it is evident that the matter is worth investigating. The best size of core can be determined from tests by balancing the increase in alternating-current conductivity against the increase in cost and size. The alternating-current conductivity is increased by the core, by reason of the copper taking the shape of a tube, with consequently less skin effect, and by reason of the larger outside diameter reducing the full-load temperature of the cable and lowering the resistance in accordance with the temperature coefficient of resistance of the copper.

A very similar problem arises in connection with high-voltage transmission lines. A 220-kv. line requires a copper cable of about 400,000 circ.mils or 500,000 circ.mils in ordinary cases. The outside diameter of such a cable is not large enough to prevent corona loss from being troublesome. A convenient way to avoid the corona loss is to increase the outside diameter by providing a steel core for the copper cable. Such a steel core will increase the conductivity of the cable, first, by changing the shape of the copper into a tubular form and thus reducing the skin effect; second, by increasing the cooling surface and lowering the temperature and the specific resistance, and third, by adding the conductivity of the steel core itself, which is an appreciable percentage. The total increase in conductivity caused by the core is probably less important than the prevention of corona, but as it may amount to several per cent it is worth while testing. It can be well tested by means of embedded temperature detectors in samples of cables with and without a core.

For example, if a current of 400 amp. at 60 cycles flowing in a 500,000-circ.mil copper cable without a core produces a temperature rise which gives 108 watts in a 25-ft. sample, as read from the calibration curve of that sample, and if the same current in a cable with 500,000 circ.mils of copper and a steel core produces a temperature rise which gives 100 watts on the corresponding calibration curve, then the core has increased the conductivity 8 per cent, by reducing skin effect, by lowering the temperature and by adding the conductivity of the core itself. This total percentage increase in conductivity due to the core may be greater than the percentage increase in cost caused by the core.

Such a comparison might result in the choice of a core of low-grade steel for a large copper transmission-line cable. A core of low-priced steel has usually better conductivity for alternating current than one of high-grade steel, though not always for direct current.

The advantages of a steel core for a transmission-line cable are that it decreases corona loss and increases the conductivity and mechanical strength of the cable. The disadvantages are that it adds to the cost, weight, ice load and wind load.

In making the tests described the samples which are to be compared may be connected in series so that there is no doubt that they carry equal currents.

Such a test would be more accurate if made in a room in which a thermostat controls electric heaters of sufficient size to hold the room temperature exactly constant. This would automatically remove many inaccuracies in measurement and is indeed a feature which would be worth installing in many physical laboratories and test departments where small apparatus is tested. It is a very easy matter to arrange except in hot weather, and the benefits of a constant room temperature are often great enough to justify a certain amount of refrigeration, so that the thermostat control of heaters could still be employed.

POSITION OF DETECTORS

In making a comparison between samples of cables it would be necessary to have the embedded temperature detectors placed in the same relative position in the different samples. For instance, they could be placed under one or two layers of the wires of the cable. The cables should be carefully shielded against draft of air.

Another similar test for which embedded temperature detectors in cables would be useful is the determination of the effect of direct sunlight in raising the

temperature of an overhead conductor and thereby increasing the sag. Thermometers would not give nearly such good results as embedded detectors in such a test on cables.

The measurement by embedded detectors of the temperature rise due to large currents in heavy conductors, in still air and in moving air, has been described by R. J. C. Wood in a paper on "Heating of Large Steel-Cored Aluminum Cables," given at the Pacific Coast convention of the A. I. E. E., October, 1924. While the measurements described were merely of temperature rise, the accuracy and consistency of the plotted readings showed that temperature detectors are precise enough to take the place of an electrical instrument in the manner suggested in this article where conditions are extremely unfavorable for the use of a wattmeter. Experience with embedded temperature detectors in large generators gives support to this conclusion.

Diesels for Operation of Small Utility

Twelve Years' Experience Shows Points Which Must Be Carefully Looked After to Insure Successful Performance and Long Life—Factors Determining Cost of Diesel Engines in Comparison with Steam

By GEORGE E. SILVER
President Ozark Utility Company, Rolla, Mo.

IN TAKING care adequately of the increasing demand for power and light in small towns the Diesel engine has answered a long-felt want. Where the old types of steam engines operated non-condensing, much economy was lost. As a result electrical energy was produced at a cost at which the average customer could not use it for domestic purposes, and the competition offered by the small gasoline engine prohibited its use in the small factories and work shops. Producing electricity by steam left the small-plant owner with a minimum of customers and consequently a very meager income. But by the use of the Diesel the operator found it possible to cut his production costs, with the result that cheaper rates could be given to the public. This in turn created a day load, whereas formerly the period of revenue was from 5 p.m. to 11 p.m. The cheaper rates improved better public relations and brought an increase in patronage. The increased domestic use has also eliminated much of the drudgery of housework, household appliances being nowhere more appreciated than in small towns. The Diesel engine has won a definite place in small-town central-station operation.

This company's experience with Diesel engines dates back twelve years, when a Diesel manufacturer placed on the market an engine which was guaranteed to produce a kilowatt-hour at less than half the cost of production by steam. One of these engines was installed which was designed to run at best efficiency on distillate or gas oil. This could be purchased at that time from 2 cents to 3 cents a gallon, delivered. With low production costs thus obtained it was possible for the company to reduce the retail price of energy considerably and yet maintain a margin of profit. This voluntary reduction of rates speedily brought more customers and soon it became necessary to install an electrical appliance department. Profit was realized from this department and the day load on the plant became greater. The cheaper power also enabled the company to offer practical power rates to the small industries of the town, and before many months passed another Diesel engine was installed.

COMPARISON OF STEAM EQUIPMENT AND DIESEL TWO-CYCLE ENGINES IN SMALL CENTRAL STATION

Steam Installation

One 275-hp. Corliss direct-connected to 200-kw. generator.
One 150-hp. Corliss direct-connected to 100-kw. generator.

Average monthly output	63,060 kw.-hr. or 94,590 b.-hp.-hr.
Average monthly fuel consumption (210 tons coal at $4.30 in storage)	$903.00
Average monthly lubricating consumption (2 bbl. engine oil at 28 cents and 2 bbl. cylinder oil at 60 cents)	69.25
Labor (Three firemen at $85 and one superintendent at $100)	355.00
Total	$1,327.25
Switchboard operating cost per kw.-hr.	$0.021

Diesel-Engine Installation

After installing two 200 b.-hp. units direct-connected to 170-kva. alternators, the average monthly production costs were:

Fuel-oil consumption (46,770 lb.) (46,770 × 0.045 ÷ 7.5)	$280.62
Lubricating oil (2,500 hp.-hr. per gallon and 60 cents per gallon)	21.02
Labor (three engineers at $90 and one superintendent at $100)	370.00
Total	$696.64
Switchboard operating cost per kw.-hr	$0.011

TWO PER CENT MAINTENANCE

One of the original engines put in service in a Missouri town of three thousand inhabitants ran from the time of its installation until July 1, 1924, at full capacity. Since July this engine has been used only for stand-by service, the plant containing it being shut down owing to the advent of transmission lines from a much larger system. This engine, however, rendered twelve years of hard service and was moved several times from one location to another. The maintenance on it over a period of twelve years amounted to less than 2 per cent per year on the original investment, including a complete rebuilding during the summer of 1924.

Of the several types of Diesel engines operated by this company, it has been found that the maintenance charge on the four-cycle type is the greatest. This, of course, might be expected, since the unit itself is more massive, has more working parts and has higher compression. But the advantages of a four-cycle Diesel are chiefly its good fuel economy, small waste of lubricant and the ease with which it is started. The semi-Diesel two-cycle engine is being supplanted by the two-cycle full-Diesel type. The departure from the old hot-ball-torch start of the semi-Diesel gives a decided advantage—one that is readily realized by the operator since the old method of hot-ball starting caused a number of serious fires and oftentimes complete shutdowns.

The two-cycle Diesel engine of today appears to be the real power source for a small utility operator. First

of all, the initial cost is considerably lower than that of the four-cycle engine. The chief advantage is the fact that less experienced workmen can be employed to handle this type of engine. This is important since high-class labor is not generally found in small towns. The two-cycle Diesel engine is virtually free from intake and exhaust valves, springs, rocker arms, cam shafts, revolving governor and the other complicated parts characteristic of a four-cycle Diesel.

Since a certain type of two-cycle Diesel engine operates without a scavenging pump, using the crank case of the pump, care must be taken in filling the engine intake with clean air. This is necessary because as the piston moves downward the air comes through the crank case and is slightly compressed. Part of this air cleans out the burned gases in the cylinder, and a part of the air is compressed in the combustion chamber as the piston moves up on the next compression stroke. In other words, this air must contain enough oxygen to insure that after cleaning out the cylinder it will still be able to ignite the next injection of fuel. This means that the utmost precaution must be exercised in procuring absolutely clean air for the engine intake. It should be taken from the outside of the building.

Cooling Water Important

Having installed two-cycle Diesel engines, two important conditions to successful operation are clean cooling water and clean lubricating oil. By watching these things the maintenance expense on this type of engine can be held below 2 per cent a year on the original investment. The cooling water should be kept free of all scale-forming substances. Lime and potash are the most detrimental to the operation of the engine, because at a temperature between 100 deg. and 120 deg. F. water in which these minerals exist will quickly form a scale in the jacket. Before starting the Diesels the water that is used for cooling should be analyzed and a suitable water softener procured. In any event, if scale does form in the jacket to a thickness of $\frac{1}{16}$ in., acid should be poured into the jacket and allowed to remain for several hours in order to free the walls of it.

Another item in lower maintenance expense is keeping the lubricating oil filter and pumps clean. The entire lubricating system should be drained off and cleaned every three to four months. The cylinder heads should be lifted and the piston and rings examined at least once in this period of time. The exhaust ports should be examined at least once a week and cleaned if necessary, as it is most important that the burned gases be allowed sufficient room for expansion. Although there is no doubt that Diesel-engine plants require far more surveillance than other types of power plants, it should not be forgotten that the Diesel operator has little to do but watch the engine, since the supply of fuel and lubricant is almost automatic.

Cost Comparison with Steam Equipment

To afford an analysis of the operating costs as between steam and Diesel engines the following data are presented. They concern a small plant the Ozark Utility Company recently changed over to Diesel operation. It is admitted that Diesel first costs somewhat exceed the cost of steam equipment, but, none the less, the Diesel equipment is not so far in the lead on first costs when consideration is taken of the price of steam equipment with all the necessary condensers, boilers, stokers, preheaters, tank traps, pipe insulation, etc. Roughly speaking, the Diesel power equipment will cost in the neighborhood of $80 to $90 per brake-horsepower, while steam equipment will average $60. Regarding economy of operation, most Diesel engines on the market today are capable of producing a brake-horsepower-hour on an average of 0.6 lb. of fuel using 18 deg. to 40 deg. Baumé oil with a heat value of not less than 18,500 B.t.u. per pound. The better class of engines will have an economy at full load of 0.46 lb. of fuel per brake-horsepower. On this basis, assuming fuel to weigh $7\frac{1}{2}$ lb. per gallon, a kilowatt-hour may be produced slightly under $\frac{1}{2}$ cent. This figure is based on the engine running at three-quarters full load.

Of course, steam-engine production cost necessarily involves many factors and conditions, and a comparison applicable to all plants is difficult to obtain, chiefly owing to different methods of firing. But the cost analysis given in the table of a plant using 450 hp. and serving a county seat of 3,500 inhabitants in Missouri is interesting. From this it is seen that a saving of approximately 50 per cent can be obtained with Diesel equipment. The same result has been attained in nearly every plant which the author has changed from steam to Diesel-engine operation. The table makes no mention of depreciation, maintenance or fixed charges. It can be seen by examining the table that a steam turbine of less than 1,000 hp. cannot compete economically with Diesel-engine operation.

Electrical Development in South Africa

ARRANGEMENTS have just been completed by the Victoria Falls Power Company for proceeding with a development in power supply in South Africa. A new power station is being erected at Witbank, about 65 miles east of Johannesburg and 5,400 ft. above sea level. It is to have an ultimate plant capacity of 100,000 kw. at 0.85 power factor.

Three 23,500-kva., three-phase, 6,600-volt, 50-cycle alternators will be directly connected to delta-star-connected banks of transformers of equivalent rating. Duplicate transmission lines at 132 kv. connect to Brakpan, a distance of 65 miles. Connection will there be made through three 22,000-kva. banks of step-down transformers connected in star-delta to the existing 42-kv. transmission and the 21-kv. distribution system.

The neutral point of the 132-kv. system is solidly earthed at both the Witbank and Brakpan ends, but the neutral points of the other systems are earthed through either resistances or reactances. Owing to the limitations of the existing switchgear, current-limiting reactances have been placed in the connections between the new system and the existing system at Brakpan.

The major portion of the switchgear will be arranged for outdoor mounting. The 2,100-volt switchgear for control of the main auxiliary motor circuit will consist of armorclad draw-out units built up into a switchboard, while the 220-volt alternating-current motor circuits will be controlled by totally inclosed units, fitted with either automatic oil circuit breakers or knife switches and fuses, according to circumstances.

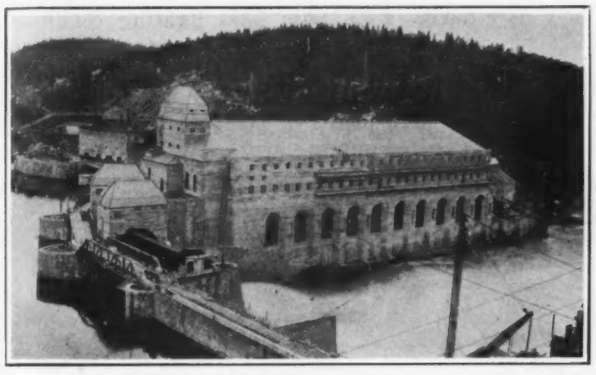
All the main circuits are arranged for remote electrical operation, and on the outdoor equipment the isolating switches will be mechanically interlocked with their corresponding oil circuit breakers.

Electricity in Oslo, Norway

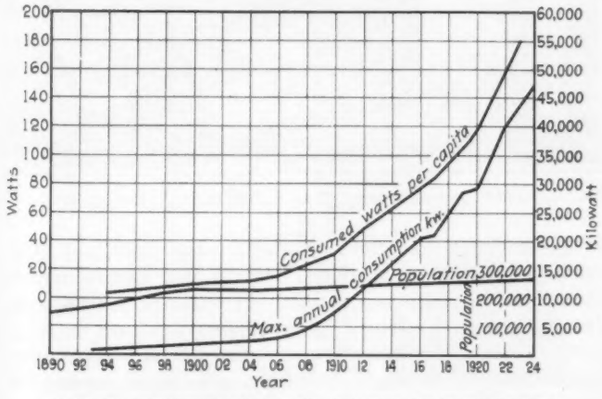
Rapid Expansion Due to Low Rate—New 150,000-Hp. Hydro-Electric Plant to Be Owned Jointly by City and State—Domestic Consumption Large

BY J. B. NAUMANN

THERE are some very interesting features in connection with the electric power supply of Christiania,* Norway. The power is at the present time mainly bought from private power plants, the city having a small water-power plant of 2,000 kw. and a steam plant of 10,000 kw. capacity which is serving as an auxiliary to take peak loads during some of the winter months. The power is locally distributed by the municipality and for household uses is sold at a flat rate, there being installed for every consumer an automatic switch which is adjusted to the number of watts contracted for. If this amount is exceeded, the current is shut off intermittently, thus giving warning to the consumer that he is exceeding the contracted amount of power. The power consumption in the city has increased steadily, and it was expected that the recent reduction of 25 per cent in rates would greatly stimulate the demand. The load has increased even more quickly than anticipated.



THE NEW SOLBERGFOS PLANT ON THE GLOMMEN WILL DEVELOP 150,000 HP.

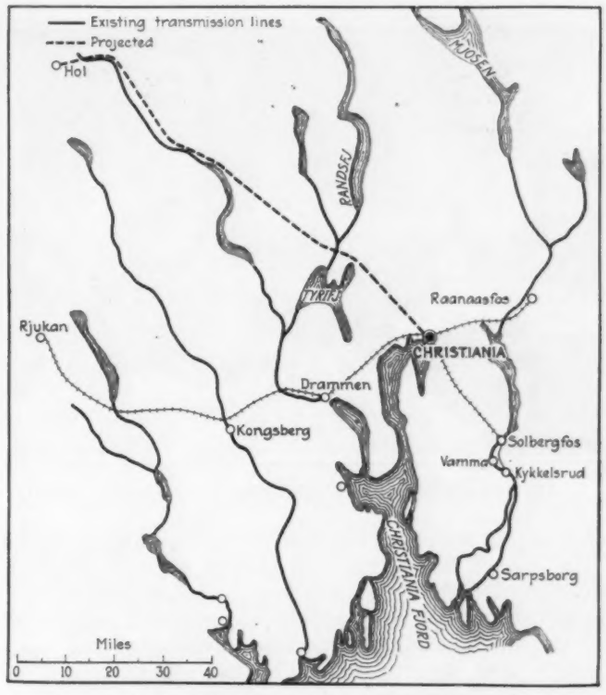


GROWTH OF POPULATION AND IN USE OF ELECTRICITY IN CHRISTIANIA

A permanent exhibition where electric appliances are demonstrated and explained has proved a valuable aid and has been instrumental in increasing the load. Further, the electricity department is going to spend 1,000,000 kroner of its earnings in an endeavor to introduce electric service into every home in the city.

The charge for electricity during the last few years has been 240 kroner, equivalent to $34.50 at the present rate of exchange, for the kilowatt-year. From the beginning of this year it was decided to reduce the rate to 180 kroner, or $26 per kilowatt-year. If the consumer could utilize this energy all the time, it would cost him about 0.3 cent per kilowatt-hour, but this is hardly possible. The low rate has had a great influence on the introduction of electric stoves, ranges, hot plates, water heaters, etc., and the load factor is growing rapidly, having been 77 on the day of maximum demand in 1922.

The city, in conjunction with the state, is constructing a power plant at Solbergfos on the River Glommen. The total installation of this plant is going to be 150,000 hp., of which Christiania will own two-thirds and the state one-third. Only about one-half of this power is to be developed at the present time, but the substructure of the power house is built for its full capacity. From this station the power will be transmitted on a 25-mile, 65,000-volt transmission line, using galvanized-steel towers. This is the first installation of galvanized-steel towers in Norway. The city owns other sources of water power, which will be developed when the demand is sufficiently large. The most important of these sites is at Hol, in Hallingdale, at a distance of about 90 miles from Christiania, where it is thought that power plants to produce 140,000 hp. can be constructed. The map shows the present and projected power plants and transmission lines for the power supply of the city.



TRANSMISSION LINES AND POWER STATIONS IN THE CHRISTIANIA DISTRICT

Interconnection of the transmission lines with other systems has been carried out to a considerable extent and with very satisfactory results. It seems to be the general opinion that such co-operation is easiest to obtain through friendly negotiations between the power producers rather than new compulsory regulations by the state.

*Now known as Oslo.

Selling More Light to the Small Store

Practical Methods Which the Boston Edison Company Has Found Effective in Appealing to Merchants and Shopkeepers Both in Metropolitan and Suburban Areas

By J. DANIELS
Illuminating Engineer Edison Electric Illuminating Company of Boston

IN BUILDING up its connected load the Edison Electric Illuminating Company of Boston has systematically canvassed a large number of small mercantile establishments during the past two or three years, and as a result a marked improvement in the lighting of these shops has been effected in many parts of the metropolitan and suburban area. An evening motor trip over this territory reveals in not a few communities an entirely new standard of illumination as contrasted with former conditions. The shops compare favorably with the best downtown establishments in this respect; goods are displayed under lighting conditions that bring out their attractions as well as in the "big" stores themselves, and the old days of slipshod, indifferent illumination are gone. Neighborhood after neighborhood has responded to the intensive canvassing of the illuminating engineering division of the company's sales department and to the nightly appeal of competitive lighting.

LEFT—LIGHTING WITH OLD, OBSOLETE FIXTURES. RIGHT—RESULTS WITH MODERN EQUIPMENT CORRECTLY INSTALLED

The sales approach to the typical small store is through company-written newspaper advertising, broadsides obtained from the Society for Electrical Development and mailed to prospective customers by the company and personal canvassing by members of the illuminating engineering division staff. Typical advertising used in the local press is shown herewith, and this material, 6½ in. x 10 in. in size, written around a non-technical central appeal of obtaining more business through better lighting, carries no little originality of make-up and readability. The aim is to put a real message into each advertisement, to make the comments of the company as direct and interesting as a personal letter, and by appropriate illustrations of "key" stores in each town which have first been equipped with modernized illumination and of the difficulties of doing business under conditions of "low visibility," and by printing testimony of satisfied users, to pave the way for the convasser.

By emphasizing repeatedly the truth that improved lighting will do for one store what it has already done for numerous others, the sales resistance of the "prospect" is lowered and the way is paved for the salesman. Long familiarity with poor local lighting conditions dulls the merchant's realization of how far behind the times his shop may be, and it is usually a matter of a few moments' study by the company's representative to "spot" enough high points of poor practice to establish a working basis for improvement. Two representatives of the division usually visit a store together, and it is usually possible in a short time to get permission to study the lighting layout without expense to the merchant. These solicitors carry photographs or halftone pictures of a wide variety of stores which have been modernized, and these illustrations create immediate interest when the merchant begins to put his mind on the subject of bettering his own establishment.

Having made it clear to the merchant that a survey of his shop will be made free of charge, the salesmen measure the store dimensions, size of windows, ceiling heights, etc., and make a pencil sketch of the existing layout. The location of doors, windows, columns and beams is indicated, the number of outlets found, and type of ceiling, background and a few other points are noted on an information blank carried in the field. It is not as a rule necessary to make foot-candle measurements in these small shops, but these are frequently calculated from the field data taken.

Returning to the offices of the division, the men turn over their field notes to a draftsman, who prepares a drawing and tracing of the store layout on which the suggested location of outlets, sizes of lamps and types of units recommended are shown. A blueprint of

the proposed improved layout is then bound between paper covers with typewritten recommendations, forming a short but specific report of the changes which should be made. The type of fixture advised is shown in a cut included in the report which briefly discusses the location of outlets, luminaires, value of good lighting, importance of cleaning and a summary of the equipment proposed.

The report is then presented to the prospective customer, and as a copy has been shown in advance to a reliable contractor for preliminary estimating, the salesman is able to approximate the cost of making the improvements when the merchant is ready to discuss it. If the decision is in favor of improving the lighting, the storekeeper is then asked to approve calling in contractors to secure competitive bids, and from this time on the central-station company takes no further part in the work other than to co-operate with the contractors in case additional information regarding services, distribution circuit capacity and any unusual requirements is needed. The engineering in these small store installations is generally simple in character, but the proposed layouts are submitted in the same clean-cut manner that would apply in a larger establishment.

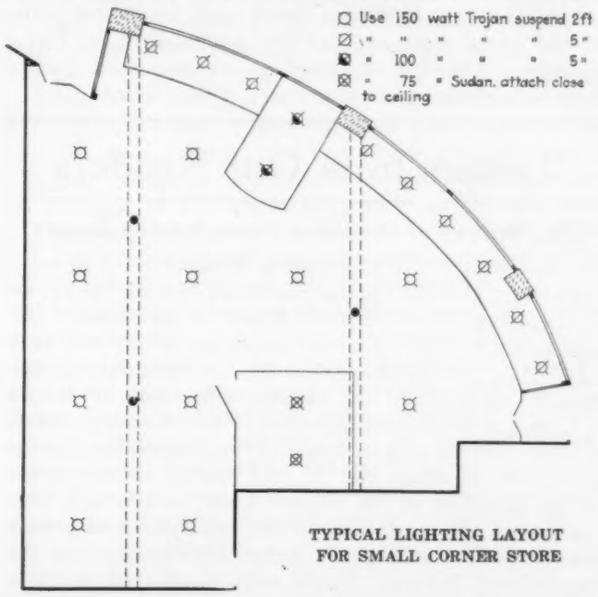
The store owner or occupant buys the lighting fixtures from a contractor-dealer or other selling agent, and the terms of financing are agreed upon without any control of loans or advances by the central-station company. It is seldom necessary to make foot-candle tests after installation is completed in these small shops.

In a typical small grocery store (George F. Richardson, Newton Center, Mass.) the former connected load was 2.1 kw. and the connected load after installing better lighting was 4 kw., an increase of 90 per cent. For the months of December, 1923, and January, 1924, with the old installation, the energy consumption was

One Thing about a Lighthouse:
It guides, by its light.
"Light is good for business," says Bates & Holdsworth
Diogenes Was Out of Luck
EDISON LIGHT
EDISON LIGHT
PHONES

ADVERTISING THE COMMERCIAL VALUE OF BETTER LIGHTING

219 kw.-hr., and for the corresponding two months a year later under the new installation the energy used was 483 kw.-hr., an increase of 120 per cent. The corresponding bills totaled $20.81 and $45.89 for service during these periods. The cost of putting in a modernized installation, including twenty-four fixtures requiring twenty 150-watt, two 100-watt and two 75-watt "type C" lamps, was $316. The lighting intensity was increased from the low initial value of between 0.5 and 1 foot-candle to 5.5 foot-candles. In most of these installations the improvement in the shop is so marked that the increased use of energy does not weigh very



TYPICAL LIGHTING LAYOUT FOR SMALL CORNER STORE

heavily with the store occupant or owner when considered in relation to the additional patronage associated with the betterment and the increased efficiency of employees.

In the past two years more attention has been paid to store-lighting campaigns than to any other one branch. Starting with the outlying towns, each one was covered until we reached the limits of the city proper. The method of procedure in all towns has been practically identical. Working in the city proper, however, necessitated certain departures from regular procedure.

The first step in campaigning a town was to select, if possible, one store to use as a "key." Photos were taken before and after the lighting was improved, and these were used, together with a letter of appreciation from the store owner, in the advertising.

One store was that of Parke Snow, Inc., Waltham, Mass., the first town in which a campaign was operated. By improving the lighting of this store an increase in the sales of 10 per cent was noted within a month. This information was included in the letter of appreciation and proved an excellent stimulus to local merchants.

One important thing, the company feels, is to make the campaign local so far as possible. Select a "key" store where the merchant can go right in and see good lighting. When the average storekeeper can compare his lighting with the modern system of his competitor or neighbor, he requires little, if any, further convincing.

Personal calls were made on every storekeeper in the district, our men following close upon the heels of the postman. In most cases our man interviewed the prospective customer immediately after the broadsides had been delivered, so that the customer had no chance to forget what was going on.

In the campaigns we have held we made layouts for 33 per cent of "prospects" in Waltham, 43 per cent in Framingham, 29 per cent in Somerville, 25 per cent in Chelsea, 21 per cent in East Boston and 25 per cent in South Boston.

The effect of a campaign lasts for a considerable period. We find inquiries coming from customers who were first brought to think about lighting at some previous time when we were campaigning their territory.

A few years ago we made a survey of the different department stores in Boston, measuring the candle intensities on the different floors, and convinced many of the store managers of the advisability of better lighting. This has resulted in an increased income from department-store customers of $45,000 annually.

Letters from Our Readers

Mr. Murray on the Giant Power Survey Report

To the Editor of the ELECTRICAL WORLD:

The first thought that arises on examining the report of the Giant Power Survey Board to the General Assembly of Pennsylvania—a report on which you have asked me to comment—is that its recommendations, embodying as they do the communistic ideas of Morris L. Cooke, director, and Governor Pinchot, have probably as much chance of acceptance by the Legislature as the proverbial snowball has in the region to which the wicked members of the "Power Trust" are bound.

It is not for me to defend the principles which were enunciated in 1920 by the American engineers of the Superpower Survey. These men, supported in their studies by the engineering departments of the American railways, industries and electric utilities, to which were added those of the General Electric and Westinghouse companies, labored not only to present the principles they advocated but also to apply them to the actual operating conditions within a territory now come to be known as the "superpower region between Boston and Washington." The object of their report as stated was first to show how savings in material and labor could be effected through the better use of electricity and what they would be in dollars and cents. In working this out the course of procedure necessarily included the location of economic power and load centers and in association with them the connecting trunk transmission lines required to insure the minimum total investment in generating machinery which at the same time would secure the maximum economic annual production of power within that region consistent with an adequate and reliable supply.

At the time the report was issued Mr. Cooke accorded it great praise. Today his chief, the Governor of Pennsylvania, presumably speaking for Mr. Cooke as well as himself, writes in his message transmitting the Giant Power Survey report:

> Giant power and superpower are as different as a tame elephant and a wild one. One is the friend and fellow worker of man—the other at large and uncontrolled may be a dangerous enemy. The place for the public is on the neck of the elephant, guiding its movements, not on the ground helpless under its knees.
>
> Giant power seeks the cheapest sources of power, and hence the cheapest rates. It proposes to create, as it were, a great pool of power into which power from all sources will be poured and out of which power for all uses will be taken. It is the pooling of supply—not the disposal of surplus—and the chief idea behind it is not profit, but the public welfare.
>
> Superpower, on the other hand, is the interchange of small quantities of surplus power at the ends of the distribution wires of each system. Its principal object is profit for the companies—not benefit for the public—and it is on the way to being realized with a rapidity which is difficult fully to understand. If we are to have giant power instead of superpower, the time in which to make sure of it is very short.
>
> The main object of the superpower idea is greater profit to the companies. The main object of the giant power idea is greater advantage to the people. Giant power will assure vastly better service and vastly cheaper rates to the consumer, and through effective public regulation it will set aside the threat of the most dangerous monopoly ever known.

Governor Pinchot signs this diatribe, notwithstanding that the trunk transmission lines and required superpower (or should I say "giant" power?) stations as agreed upon by the engineers of the Superpower Survey report within the territory between Boston and Washington are shown on the 1925 and 1930 maps (page 14) of that report. In addition to this, Mr. Cooke, with his "clear vision" of what the American engineers have meant by superpower, likens it to the interlacing of leaves and twigs over a street shaded with a row of elms on each side, adding, "Only a squirrel can pass from one to the other," and also says: "An interconnection of this kind exists and is coming to be common practice in the electrical industry."

I do not like to appear disrespectful in a matter involving so eminent a citizen as Gifford Pinchot, Governor of the second largest state in the Union, and it seems to me scarcely necessary to discuss the papers that follow the Governor's message and which are called a report, but which give no conclusions. Tersely stated, the apple is rotten and rotten at the core, and the core is the Governor's message. In addresses I have made (and one before the Philadelphia Chamber of Commerce at this moment particularly comes to mind) and articles I have contributed to the technical press and engineering societies since the conception of co-ordinated electric utility operation came to my mind —a plan of operation to which I applied the word "superpower"—it has been my belief that, because of the past record of the electric utility companies under the regulation of the public service commissions of this country, there exists public appreciation of the fact that the utility companies and the commissions have met their responsibility for the production of adequate, reliable and economical power. Where either may have failed a watchful public has found the courts ever ready to apply the remedy.

I stand as firmly upon this ground as I did five years ago, when under the influence of my first conception of superpower. I am not misguided enough to feel that either the commissions or the electric utility companies at this moment are functioning at an efficiency of 100 per cent, but I am impressed with the record of their progress and my faith is strong in them. So, too, I believe, is the faith of the American people.

Another paragraph in the letter of transmittal of this great Governor says:

> We complain, and with justice, that the cost of food doubles between the farmer who grows it and the housewife who buys it, but if the cost of electric current only doubled between the generating station and the householder's meter, the present rates would be cut into small pieces. Producers of electric current commonly sell it to large consumers for one-fifth or one-tenth of the price they charge to the head of a family and for much less than the small industrial consumer pays. It is the small consumer—the average consumer—to whom the companies charge their highest rates.

Suppose my unsophistication in the field of economic power production had reached such heights as these and I had been led to include a statement like this in the Superpower Survey report, do you think that the whole engineering staff of the survey would, in answer

to my inquiry of them at the completion of our work, "Are you unanimously in agreement with the findings of this report"? have replied "Yes"? Is it necessary to say that a paragraph of this character indicates complete ignorance on the part of Governor Pinchot of the true economic power structure? If Mr. Cooke knows, he surely did not tell his chief that 80 per cent of the cost of power to the consumer lies in getting that power to the consumer after it has been generated.

Under the caption of "Electric Monopoly" the Governor says:

> Nothing like this giant monopoly has ever appeared in the history of the world. If uncontrolled, it will be a plague without previous example. If effectively controlled in the public interest, it can be made incomparably the greatest material blessing in human history.

Again, under the caption "The Greatest Economic Question," he winds up by saying: "Either we must control electric power or its masters and owners will control us."

Fine faith he has in these two great bodies, the public service commissions of this country and the electric utility companies, whose combined efforts for the people, in the face of rising prices in the commodities which they have had to use both for the creation of power plants and transmission lines and for operating them, have resulted in steadily lowering the cost of power to the consumer.

It would have been well if the Governor and his aide-de-camp had picked something other than the electric utility business to censure. It is common practice with some men to camouflage by a change of name their appropriation of the ideas and thoughts of others. The pathetic feature in this case is that, having picked the word "giant" in opposition to "super," they have endowed "giant power" with attributes which any ordinary engineer can see are inimical to economic regional power production. For instance:

1. It is "pretty words" perhaps to talk about the transference of larger blocks of power between power stations, but it is silly.

2. It is "pretty words" to talk about putting vast quantities of coal through by-product processes before using it for power, but it is silly.

3. It is "pretty words" to talk about supplying all the farmers in Pennsylvania with power, but it is silly.

In the first case the proposal would be flagrant duplication; in the second case the market for the by-products does not exist, and in the third case the farmer himself has sense enough to know that thousands of miles of sub-transmission line for his benefit or that of any one else are not an immediate possibility. Need I add that I am entirely in favor of rural service, but only to the degree dictated by common sense and good judgment, so that one class shall not be subsidized at the expense of others?

Transgressing for a moment my purpose to go no further than the Governor's message, the citation in the Giant Power Survey report of a plan for legislative enactment by the State of Pennsylvania (pages 3 to 10 inclusive) deals with the methods to be pursued in the development, transmission and distribution of the power resources of that state. If such a plan were adopted, it would spell the death of initiative, the duplication and impossible use of transmission equipment, and introduce a financial entanglement which would kill the production of adequate, reliable and economic power.

W. S. MURRAY,
Consulting Engineer.

New York, N. Y.

The Great Practical Value of Heaviside's Mathematical Researches

To the Editor of the ELECTRICAL WORLD:

With the death of Oliver Heaviside the last of a remarkable group of British scientists, which included Kelvin, Maxwell and Rayleigh, has passed away. To this group the world is indebted for the origin and development of classical electromagnetic theory.

It would be premature, and on my part presumptuous, to attempt as yet to make a critical estimate of the value of Oliver Heaviside's scientific work. His work, however, more than that of any of his contemporaries, not even excepting Kelvin, was closely related to the development of the engineering theories of electrical transmission. It is with reference to this and one other phase of his researches that, as a communication engineer, I should like to pay my modest tribute.

When Heaviside started his brilliant series of papers, later incorporated in his "Electrical Papers" and "Electromagnetic Theory," the theory of electrical transmission along wires was in an extremely unsatisfactory state. Kelvin's work showing the possibility of transatlantic telegraphy was virtually the only theoretical guide. This work, while extremely valuable and an adequate guide even today in long-distance, low-speed telegraphy, is quite inapplicable to telephonic transmission. Nevertheless, it was officially adopted by the engineers of the British Post Office as the theoretical basis of telephonic transmission. As a consequence, costly mistakes were made, and it was even seriously proposed to increase the electrostatic capacity of the telephone line as an aid to telephone transmission.

Heaviside, in a number of characteristic papers, completely demolished the theory and laid the complete foundations of the modern theory of telephonic transmission. In particular he analyzed the factors which distort the signal, pointed out the prime importance of inductance and introduced the idea of the distortionless line. The practical importance of this early work of Heaviside's, leading as it did to the loaded line, can hardly be exaggerated and is fully and adequately recognized today throughout the world.

One aspect, however, of this work is known only to specialists and is certainly not recognized to the extent its large value merits. This is the mathematical method originated and developed by Heaviside in connection with his studies of wire propagation phenomena. This method I have ventured to call the Heaviside operational calculus. In the large class of physical problems to which it is applicable it is of incomparable directness and simplicity, and by its aid the solution of the differential equations of electric circuit theory is virtually reduced to a mere matter of elementary algebra. The operational calculus is expounded at length in "Electromagnetic Theory." Unfortunately, however, Heaviside's exposition is difficult reading—a fact which has served to discourage many students and retard its general use. The value of his operational calculus, however, is becoming increasingly recognized. In my own technical work for the American Telephone & Telegraph Company I have found it of the greatest value in the solution of important practical problems. I desire, therefore, to pay my personal tribute of indebtedness to Oliver Heaviside and to express my appreciation of his greatness as both engineer and mathematician.

JOHN R. CARSON.

Department of Development and Research,
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Central Station and Industrial Practice

Copper Sulphate Being Used Around Ground Plates

BY E. R. STAUFFACHER
Protection Engineer Southern California Edison Company, Los Angeles

SOME interesting tests have been made by the Southern California Edison Company which clearly indicate that copper sulphate is preferable to salt for use around copper ground plates for station grounds.

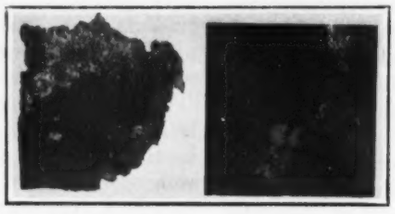
Copper sulphate (blue vitriol, bluestone, $CuSO_4$*) has nearly twice the solubility of common salt (NaCL) at ordinary temperatures, and owing to the widespread use of blue vitriol for commercial purposes it can be obtained at a price which does not materially increase the cost of the completed ground as compared with the use of salt for this purpose.

Test plates surrounded by coke were buried in models of ground wells, some in the presence of moisture and salt and others in the presence of moisture and copper sulphate. The models or miniature wells were opened after three months, and it was found, as may be seen in the accompanying illustrations, that where the salt was used the copper wires leading to the plates were eaten off and about a third of the area of the plate itself had wasted away. In addition, the plates were covered with a substance which was presumably a chloride compound of copper. The plates surrounded with copper sulphate were only slightly pitted.

*To be technically correct, this should be $CuSO_4+5H_2O$.

BILL OF MATERIAL FOR COMPLETE TERMINAL BLOCKS

One concrete block as shown in the drawing
One copper bar
½-in.x¾-in. galvanized cap screws
Six ½-in.x4-in. galvanized machine bolts with hexagonal nuts
Pieces of 1-in. garden hose 15 ft. long
210 lb. copper sulphate
2,400 lb. powdered coke
Thirty-two cost copper cable clamps
4-in. sewer tile
Four ¾-in. "copper-weld" ground rods
Three ⅛-in.x30-in.x30-in. copper plates
Thirty-two ½-in.x2-in. brass machine bolts
Four ground clamps



TEST PLATES SHOWING EFFECT OF SALT AND COPPER SULPHATE SOLUTIONS ON COPPER GROUND PLATES

Left — Copper plate partly eaten away and covered with copper chloride as a result of the presence of salt. Right—Copper plate surrounded with copper sulphate is only slightly pitted.

These tests led to the use of a standard type of ground well composed of three copper plates, 30 in. x 30 in. and ⅛ in. thick, placed at different depths in the well, which sometimes reaches a depth of 25 ft. Two No. 4/0 stranded copper leads are bolted to each plate and brought up to the surface. The plates are completely surrounded by 2,400 lb. of coke and 210 lb. of copper sulphate. Care is taken to avoid placing the ground well in the domestic water-bearing strata so that no contamination of the domestic water due to an excessive amount of copper sulphate will result.

SIZE OF BLOCKS FOR NUMBER OF TERMINALS

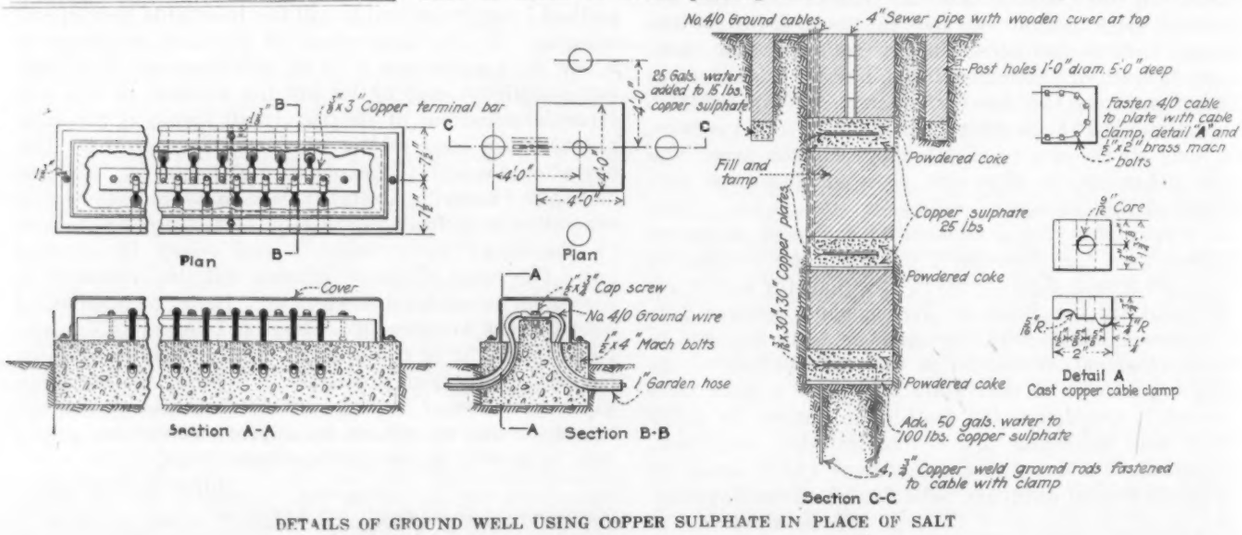
Number of Terminals	Length of Block Ft.	In.	Number of Terminals	Length of Block Ft.	In.
4	2	4	18	4	8
6	2	8	20	5	0
8	3	0	22	5	4
10	3	4	24	5	8
12	3	8	26	6	0
14	4	0	28	6	4
16	4	4	30	6	8

It is also of interest that the distribution department is using copper sulphate around pipe grounds for transformer neutrals. It has been found that the pipe is not eaten away as when salt was used and that the tendency is to deposit copper on the galvanized pipe, which serves further to protect it.

Testing of Transformers After Repair

BY F. I. MANVEL
Transformer Engineering Department, General Electric Company, Pittsfield, Mass.

RECENT experience has shown that there should be some understanding among repairmen as to simple tests which would indicate faulty connections in transformers. There are several ways of discovering a mistake in connections, one of which is the measurement of losses. This method is complicated and in-


No. 4/0 Ground cables
4" Sewer pipe with wooden cover at top
Post holes 1'-0" diam. 5'-0" deep
25 Gals. water added to 15 lbs. copper sulphate
⅜"x3" Copper terminal bar
Fasten 4/0 cable to plate with cable clamp, detail A and ⅝"x2" brass mach bolts
Fill and tamp
Powdered coke
Copper sulphate 25 lbs
⅜"x30"x30" Copper plates
⅜" Core
Powdered coke
Powdered coke
Detail A
Cast copper cable clamp
Add 50 gals. water to 100 lbs. copper sulphate
4, ¾" Copper weld ground rods fastened to cable with clamp
Section C-C
Plan
Plan
Cover
⅝"x3" Cap screw
No. 4/0 Ground wire
½"x4" Mach bolts
1" Garden hose
Section A-A
Section B-B

DETAILS OF GROUND WELL USING COPPER SULPHATE IN PLACE OF SALT

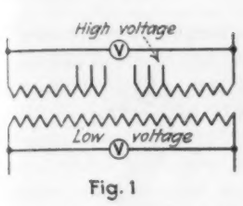


Fig. 1

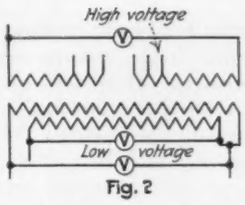


Fig. 2

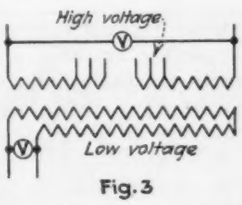


Fig. 3

FIGS. 1 TO 3—FAULTY CONNECTIONS DISCOVERED BY MEANS OF RATIO MEASUREMENTS

convenient, requiring accurate meters and definite voltages. Then, again, taking the core loss necessitates complete assembly, drying and tanking before making tests. Thus the measurement of losses as a general practice is not to be recommended.

It is now common practice among some repairmen to measure ratio, for this is a simple and convenient test which can be made accurately at voltages below normal. It is, therefore, the most reliable method. In the case of windings with two or more circuits in parallel, simple ratio measurements, as shown in the accompanying illustrations, will determine whether or not correct connections have been made.

A simple two-winding transformer with taps on one side and no parallel circuits is shown in Fig. 1. The custom is to read the ratios on each side of the winding, applying voltage to one side and reading the other, or, better still, reading the two simultaneously and checking each tap for progressive steps to make sure that the arrangement of taps is in accordance with the nameplate sketch.

A transformer having two parallel circuits in one winding is shown in Fig. 2. In this case obviously the two halves of the two-circuit winding should have identically the same turns and therefore the same voltage. When such a winding is encountered, only one end of the parallel circuits should be connected until after tests are made. In the usual way, the ratio of the two sides of the transformer should be measured, making a separate measurement for each of the multiple circuits. A check may be made as shown in Fig. 3.

In either case mentioned—that is, whether the voltages appear to be identical or if there seems to be a slight difference—keeping the same applied voltage on one side and measuring the voltage between the two or more parallel circuits on the open end of the multiple connection will determine whether or not there is a difference. If there is a possible difference due to connections of one or two turns, the amount of the voltage, if connected wrong, will not be very great and may usually be read direct with a voltmeter. If this reading, however, shows no voltage, it can further be checked by using a potential transformer to step up the voltage across this open connection, and the voltmeter may be placed across the high side of the potential transformer. This latter procedure, however, should not be followed unless all the tests indicate that there is no voltage at this point.

A further check on connections can be made, when the transformer is reassembled and dried out, by measuring the exciting current at normal voltage and frequency. This current, however, may vary from the original factory tests by 10 or even 20 per cent, due to restacking of the iron, difference in metering equipment or difference in wave shape or exact frequency. But any actual mistake in connection of turns would undoubtedly throw this exciting current off to a much greater extent than the above limits.

Method of Measuring Electrolysis

Galvanic and Stray Current Components of Current-Producing Electrolysis Determined by Using Sleeve Electrode and Recording Ammeter

BY B. A. WILLIAMSON
Electrolysis Engineer Los Angeles Gas & Electric Corporation

IT IS important that there be available a method of detecting and measuring electrolysis in order that the proper steps may be taken to mitigate the trouble, whether it be soil or electrolytic corrosion, and the responsibility therefor determined. A method is here described for measuring directly the galvanic and the stray current components of the current-producing corrosion of underground metallic structures.

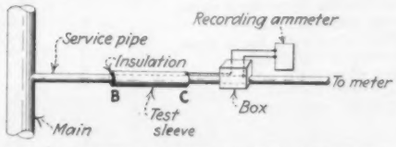


FIG. 1—SLEEVE ELECTRODE FOR DETERMINING ELECTROLYTIC CURRENTS PRODUCING CORROSION

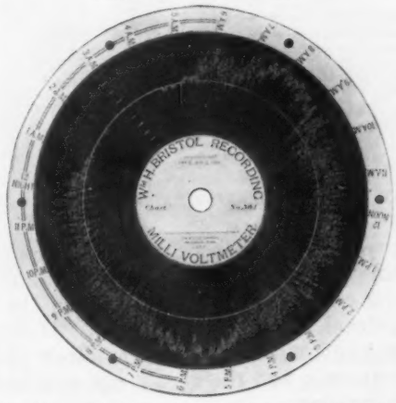


FIG. 2—CURRENT DUE TO GALVANIC ACTION CONSTANT AT A VALUE INDICATED BY THE CIRCLE OF REFERENCE

Electrolysis is caused by and is proportional to earth currents, usually caused by leakage from street-car tracks, the intensity of which per unit area of surface in contact with the soil determines the rate of electrolytic decay. In Fig. 1 is shown a section of a main and service pipe under examination for electrolysis. If stray currents exist, the pipes will have a positive potential with respect to the surrounding soil. For the purpose of test a pipe is installed adjacent to the service, by being either laid or driven in the soil or for a more accurate test slipped over the service pipe, as shown.

The sleeve is kept concentric and insulated from the service pipe by an insulating compound filled in at the ends of the sleeve. The sleeve and service pipe are electrically connected through a low resistance ammeter. The current registered by this instrument will vary with the fluctuations in current in the rails and in many instances will cease during the early morning hours when street cars are stopped. In addition to this vagrant current there will be a constant galvanic current of a value determined by the resistance and character of the soil and the potential difference between the service pipe and the sleeve due to their chemical inequalities.

In those instances where there is a cessation of street-car service at

some time during the twenty-four hours a recording ammeter will register the algebraic sum, I_t, of a vagrant current, I_v, and the galvanic current, I_g, during the hours of street-car operation and during the remainder of the time will register I_g alone. It is evident that if I_g is subtracted from I_t as given on the chart, with due regard to polarity, the difference will be the vagrant component I_v or the stray current from the rails.

If a new sleeve be installed on an old pipe, there will probably be an undue amount of galvanic action at first due to the difference in surface conditions. This current, however, no matter what it may be, will be registered separately from the stray current leaving the pipe, so that the results of the test will not be materially altered. The ends of the test wires should be connected together when not in use in order to maintain the same corrosive action on the sleeve as though it were a part of the service pipe itself. The sleeve will gradually acquire the same rust incrustation as the pipe line under test, and the surrounding soil will absorb salts, with the result that later tests will be more accurate. It is important that the sleeve should me made of the same material as the pipe which it surrounds, to reduce chemical action to a minimum and to avoid the error due to polarization and film resistance.

A recording millivoltmeter may be made to register milliamperes by use of a suitable low-resistance coil calibrated as an ammeter shunt when connected across the 0.005-volt or 0.010-volt terminals. If the chart shows for the early morning hours a perfect arc of a circle, this indicates the period of non-operation of street cars and gives to scale the measure of the galvanic current. A circle should be drawn to include the arc described by the recording instrument due to the galvanic current. The measure of the electrolytic current in polarity and intensity can then be reckoned directly from this circle of reference as a base. The chart of Fig. 2 indicates clearly the constant galvanic current which is flowing. The chart has a full-scale deflection of 0.1 amp. The current due to galvanic action is shown to be a constant current of 0.009 amp. between the hours of 2 a.m. and 4 a.m., when no cars were running. The direction of this current with respect to the electrode was positive, or toward the soil. The flow of current during the remainder of the day, which included both galvanic and stray current, was also positive, or away from the pipe into the soil. In this particular case the algebraic difference between the two currents would be the same as the arithmetical difference. In order to avoid making these subtractions, which are confusing, it is preferable to describe a circle of reference with a bow pen which defines the constant galvanic current. The electrolytic current may then be measured from this line as a base as though it were the circle of zero deflection and the galvanic current did not exist. If no galvanic current exists, the circle of reference and the zero circle will be coincident.

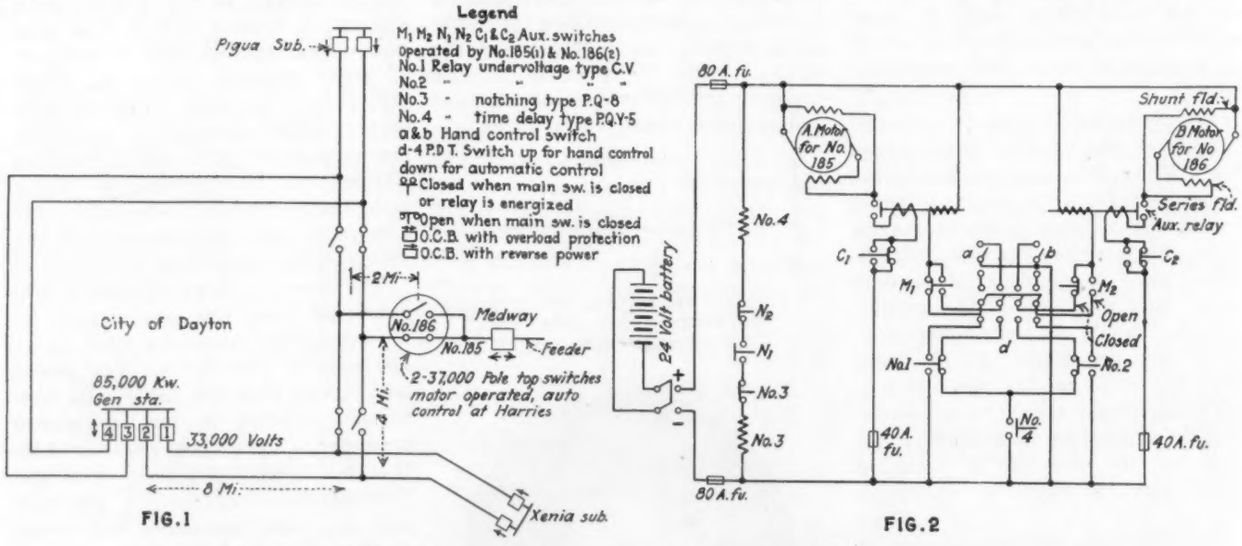
The sleeve electrode used in this case had an area of 10 sq.ft., and the chart shows an average of 0.034 amp. for the eighteen-hour period between 6 a.m. and 12 p.m. This gives an average intensity of electrolytic discharge of 0.0034 amp. per square foot of surface, which is considered by the writer to be a rather severe electrolytic condition.

Automatic Control of Motor-Operated Air Switches

BY R. E. FINLEY
Dayton (Ohio) Power & Light Company

BY applying a simple automatic control to motor-operated air-brake switches this company is able to have the switch operated in from one-half minute to three minutes where formerly it required a trouble-man dispatched from the service building from fifteen minutes to two hours. The service concerned is a 33,000-volt feeder to the Indiana, Columbus & Eastern Traction Company's lines, which supply power for about 125 miles of electric railway and also light and power to customers along the right-of-way.

The two air-break switches, made by the Electric Power Equipment Company, which are shown in Fig. 1, allow this feeder to be transferred from one line to another, giving two chances of maintaining service in case of trouble. The disad-



FIGS. 1 AND 2—ARRANGEMENT OF MOTOR-OPERATED AIR-BREAK SWITCH WITH AUTOMATIC CONTROL

vantage of having to send a man out to change switches right at the busy time which follows an outage and the delay involved are apparent.

The present arrangement of motor-operated air-break switches with automatic control provides for an immediate transfer of the Indiana, Columbus & Eastern feeder from

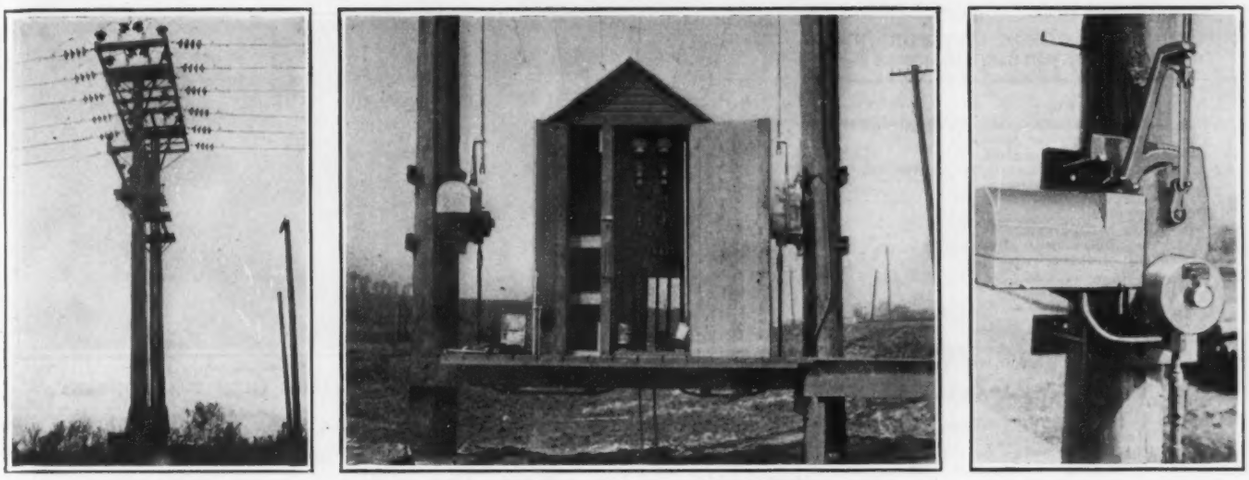


FIG. 3—INSTALLATION OF AUTOMATIC AIR-BREAK SWITCHES

one circuit to another in case the first circuit is taken out of service by its oil circuit breakers. The station will then reverse the operation if the second circuit goes bad. Three consecutive operations of this kind would indicate that the trouble was being switched with the feeder, so a notching relay is provided to lock both switches open after three operations a minute or less apart.

This automatic transfer station has been in operation for about one year, has had fifteen correct operations and has never failed to operate. Monthly inspections are made, at which time by removing the connecting rod the motors and control are operated without disturbing the switches. The relay contacts are also brightened up with crocus cloth.

On the initial test the two breakers were made to open the full-load current (approximately 75 amp.) three times, which they did, breaking the arc promptly. A defective transformer installed near Harries caused enough drop in voltage (50 per cent) to operate the low-voltage relays without drawing enough current to cause the overload relays to operate at the generating station. This resulted in the air-break switches opening under overload, which they did without any damage.

The arrangement of the control for the two switches at Harries is shown in Fig. 2. With switch d in the up position, either of the line switches may be opened or closed at will by closing the switches a and b in the up or down position. M_1, M_2, C_1 and C_2 are auxiliary switches operated by the line switches, which control the operation of the motor so that it exactly opens or closes the line switch.

With the switch d in the down position, the operation of the switches becomes automatic. The control switches a and b are replaced by the contacts of two undervoltage relays, one of which is connected to each line through a potential transformer. The contacts are so arranged that when the line is de-energized the motor is operated to open the switch. When the line is energized the undervoltage relay closes another set of contacts, which partly completes the closing circuit of that line switch. In order to complete the closing circuit of either switch, the contacts of No. 4 relay must be closed. This is accomplished by means of additional auxiliary switches (N_1 and N_2) mechanically operated by the line switch the same as the M and C switches. N_1 and N_2 are closed when their line switches are open.

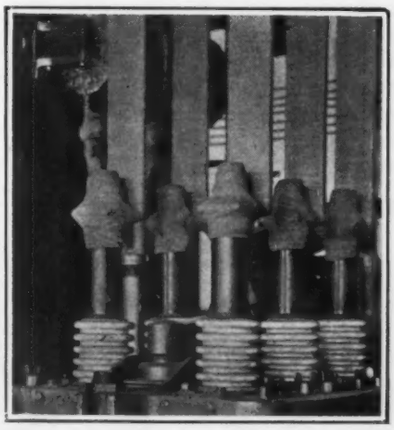
Thus, from the diagram, it can be seen that a line switch can close when its line is energized and both switches are open. If a permanent short circuit were to develop between Harries and Medway, the automatic operation of these switches would keep two lines in trouble. This condition is taken care of by a notching relay No. 3, which opens the closing circuit permanently after three consecutive closing operations.

A small lever is provided on the motor mechanism to disengage the gears, after which the switch may be operated by a removable hand crank.

The time settings for the different relays are as follows: Nos. 1 and 2 close in one second at 110 volts and go from closed to open position in three seconds with zero volts. No. 3 notches instantaneously and restores in one minute. No. 4 closes in twenty-five seconds and opens in five seconds. The time of operation for the line switches is one and one-half seconds. Oil circuit breakers are reclosed one minute after they open on overload.

Taping Substation Buses

ALL interior substation buses of the Utica Gas & Electric Company are taped to prevent any possible accident such as coming in contact with live parts or the short-circuiting of phases. For 4,000-volt construction three layers of cambric, half-lapped, and two layers of stay binder are employed. On 13,200-volt construction six layers of cambric, half-lapped, and two layers of stay binder are used.



TAPED BUS-TIE SWITCH

Checking Regulator Specifications

ONE utility company in the East has found it very convenient when ordering or specifying induction-type feeder regulators to have a tabulation such as is shown herewith available at the time the specifications are made out. Such a tabu-

SPECIFICATION CHECK LIST FOR INDUCTION FEEDER REGULATORS

1. Type.
2. O.I.S.C. or O.I.W.C.
3. Indoor or outdoor.
4. Phase—one, two or three.
5. Hand or motor-operated.
6. Automatically or manually controlled.
7. Kilovolt-ampere rating.
8. Cycles.
9. Primary volts.
10. Secondary amperes.
11. Per cent boost and buck.
12. Operating motor:
    - (a) Phase.
    - (b) Voltage.
    - (c) Cycles.
13. Auxiliaries to be included:
    - (a) Potential transformers (ratio).
    - (b) Current transformers (number and ratio).
    - (c) Primary relay or contact-making voltmeter.
    - (d) Primary relay resistance (if not in compensator).
    - (e) Secondary relay or relay switch.
    - (f) Line-drop compensator, type.
    - (g) Necessary oil.

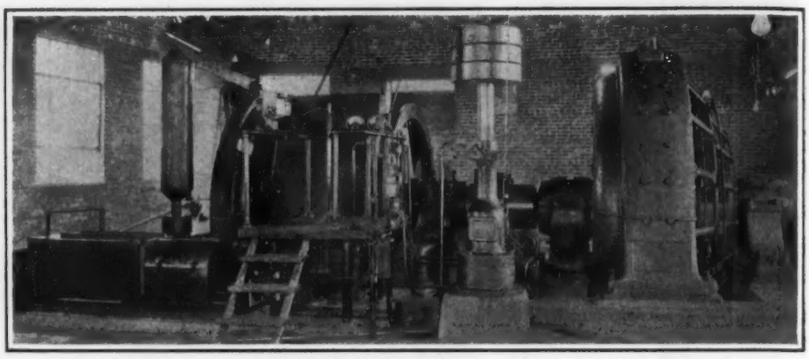
lation makes it possible to get the order out in minimum time and still have every detail covered. Confusion on the part of the manufacturer in interpreting the specifications and subsequent delay in delivery is avoided. This checking list is kept readily available by the man who is responsible for material specifications.

Record Coal Mine Electrically Operated

Valier Mine in Southern Illinois Establishes New Mark by Hoisting 8,664 Tons in One Day

THE electrically operated mine of the Valier Coal Company of Valier, Ill., on November 25, 1924, in eight hours hoisted more coal—8,664 tons—than any single-shaft mine, so far as is known, ever produced before in the history of coal mining. This exceeds by 446 tons the greatest day's hoist which was recently produced by the Orient Mine No. 1 of the Chicago, Wilmington & Franklin Coal Company at West Frankfort, Ill.

The Valier mine, owned and operated through a subsidiary by the Chicago, Burlington & Quincy Railroad, has long been recognized as a good 6,000-ton producer, but it was not expected to break a world's production record. The remarkable day's run on November 25 was made without any previous notice. In the eight hours of hoisting on that day the time lost at the Valier Mine totaled nine minutes. Two minutes were required for cleaning the sump, three were lost by the cars becoming jammed in the dump, power was off for one minute and three more minutes were consumed in re-railing a load on the bottom. A total of



SEMI-AUTOMATIC HOIST EQUIPMENT OF THE VALIER (ILL.) COAL COMPANY

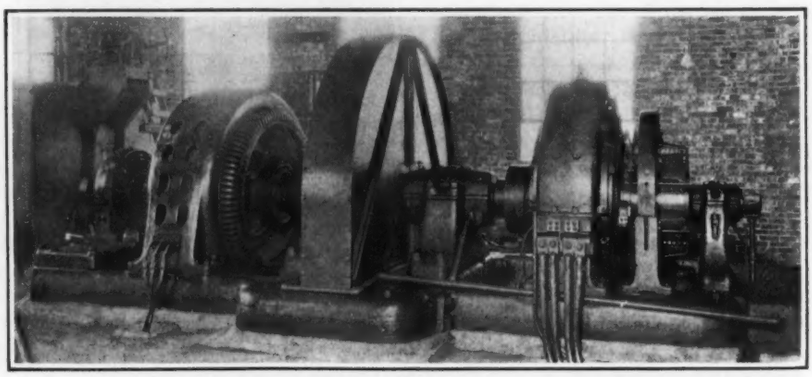
2,036 dumps were made during the day, which gives an average load of approximately 4.3 tons per car. One of the factors that permitted this large output is doubtless to be found in the generous capacity of the cars. Only 600 mine cars were in service on the day in question. On November 26, the day following the record production, the mine was able to produce 7,763 tons without any unusual effort, which seems to justify the claim that this mine has the record for the greatest tonnage ever hoisted from a single shaft.

Inasmuch as the Valier mine has established a world's record for a mine equipped with an electric hoist, data on the hoist equipment will be of interest. The hoisting unit in the Valier mine is of the skip type, driven by a General Electric motor, using Ilgner-Ward-Leonard control. The depth of the mine shaft is 672 ft., and the skip has a capacity of 15 tons. The hoist motor is rated at 1,350 hp. at 55 r.p.m. Power for the direct-current hoist motor is supplied from a flywheel motor-generator set, which includes an 1,100-hp. induction motor, a 1,000-kw. direct-current generator and a flywheel weighing 31,000 lb. A slip regulator is used in connection with the induction motor. The motor-generator set operates at 720 r.p.m.

The hoist is arranged for automatic acceleration, slow-down and stop. It is only necessary for the operator to close the control switch in order to start the hoisting cycle. A pilot motor then turns the controller to the full-speed position, whereupon this motor is cut off and the clutch released. Near the end of the travel of the hoist cams turn the controller to the off position, and the brakes are then automatically applied.

The hoist was installed in 1917 and was designed to hoist 940 tons per hour. Tests made soon after installation showed actual capacity of 1,058 tons per hour. Contemplated changes in the arrangement of the skips are expected to increase the production capacity of the hoist. The duty cycle for which the hoist was designed was: Six seconds for acceleration, eighteen seconds at full speed, ten seconds for retarding, eight seconds rest period—a total of forty-two seconds. The changes contemplated are expected to cut down the rest period and thereby increase the capacity of the hoist.

The Valier mine is one of the 107 coal mines for which electric service is supplied by the Central Illinois Public Service Company and is totally electrified with purchased power.



FLYWHEEL MOTOR-GENERATOR SET FOR SEMI-AUTOMATIC HOIST

Commercial Activities and Public Relations

New Customer-Owners Reflect Good Public Relations

READINESS of customers and the public to invest in the stock of local utilities is a fairly accurate barometer of a company's standing in the community it serves, and the extent to which the Washington Water Power Company of Spokane has been building better public relations is reflected in its recent customer-ownership activities.

During 1924 the company sold 9,955 shares of its common stock to 1,969 new stockholders. This stock has for some time paid dividends at the rate of $8 per share and was sold at $108 per share until November of last year, when the price was advanced to $111. On January 1, 1925, the company had 5,443 individual stockholders and subscribers for stock, of whom about three-fourths are residents of the territory served by it. A year ago the company had about as many Eastern stockholders as Western.

These results have been obtained largely through the efforts of the company employees, who act as stock salesmen under the direction of W. H. Ude, director of public relations. An aggressive campaign will be continued throughout 1925, and the results for January show that an excellent start has been made. During that month about 2,000 shares were sold and 349 new stockholders were added.

Irrigation Pumping Makes Desirable Power Load

THE Coast Valleys Gas & Electric Company, operating in central California, is building a very desirable power load in pumping water for irrigation purposes. Growth in the number and horsepower of agricultural pumps in use during the last four years is shown in the tabulation below. Additions during 1924 surpassed all previous records because of the drought which last summer affected the region served by this company.

Year	No. of Pumps	Hp.
1920 in use	162	7,976
1921	22	858
1922	22	612
1923	45	1,385
1924	108	2,408
Total	359	13,239

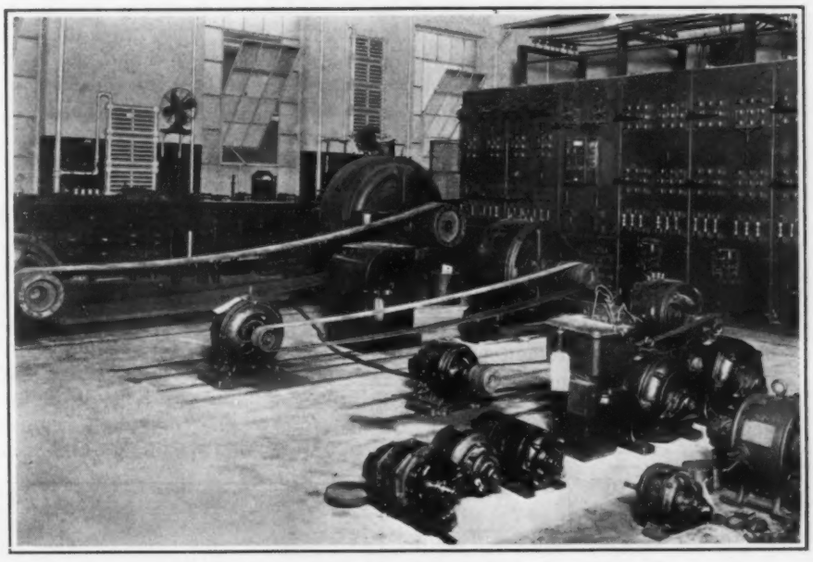
A large part of this additional business has developed with the establishment of artichoke and lettuce culture, both of which require a great deal of water over a long season and therefore constitute a very attractive power load.

Motor Service for Power Users

Advantages to the Central-Station Company of Carrying a Stock of Motor Equipment Which Insures Prompt Service to Customers

BY R. C. NILES, JR.
Industrial Power Department, Consolidated Gas, Electric Light & Power Company of Baltimore

AS APPROXIMATELY 80 per cent of the Consolidated Gas, Electric Light & Power Company's output of electrical energy is used to operate motors, the company is vitally interested in having available at all times adequate motor equipment for prompt installation for new customers or temporarily to replace motors that have been damaged. For this reason the company has found it profitable to itself and of considerable advantage to customers to carry a widely assorted stock of motors, transformers, rotary converters and other miscellaneous equipment for direct sale to power users. Such a stock is particularly desirable in enabling the company to give prompt service as factory deliveries are often delayed and even when available time is consumed in transportation.



SECTION OF MOTOR TESTING DEPARTMENT

The Baltimore company supplies both single and three-phase service at frequencies of 62½ cycles and 25 cycles, and also direct current in a limited section of the city. To meet any emergency which may arise a large stock of diversified types and sizes must be carried.

The majority of large power customers in Baltimore are established in what is known as the 25-cycle district, and a stock of about one hundred 25-cycle motors ranging from ½ hp. up to 200 hp., and totaling approximately 2,000 hp., is carried. For the 62½-cycle service ½-hp. to 100-hp. motors are stocked, consisting of sixty to seventy-five motors of both squirrel-cage and wound-rotor type, totaling approximately 500 hp. to 750 hp. The direct-current district being limited, only a small stock of from thirty-five to forty

motors is carried, aggregating approximately 175 hp., ranging in size from ½ hp. to 75 hp. Having at all times this well-assorted stock of motors enables the company to care for practically any emergency job that is presented and to sell motors direct from its storerooms. Frequently it is necessary to bring a customer's motor in for repairs, in which case, in order to prevent loss of production by the customer, he may rent one of the stock motors at a very nominal charge until his motor is ready to go back in service. This service is likewise available to any manufacturer using other sources of power supply. No distinction is made between a customer and a non-customer; in fact, the company welcomes the opportunity of giving assistance to the isolated plant, and in several instances this willingness has resulted ultimately in connecting the business to our service.

This stock also enables the company to take in or exchange old motors. We have many instances of a customer replacing old motor drives with larger motors, and arrangements can always be made whereby the customer's existing equipment is taken in at a fair price valuation toward the purchase of a new motor. Having the larger motor for immediate delivery always makes a satisfied customer, as while he may have been contemplating the change for months, it has been our experience that when a change is finally decided upon, the customer will be disappointed if he cannot obtain his new motor promptly.

The motor stock has also been the means of effecting sales of energy to building contractors through temporary connections. Because of the character of service being different at various locations, it has never been attractive to the building contractor to own motor-driven apparatus. However, since our stock has been available, many have availed themselves of the privilege of renting motors for the period of their building operations.

As a necessary adjunct to carry on this work satisfactorily and expeditiously, we have a machine and electrical repair shop equipped with modern machinery to repair and recondition second-hand equipment, after which it is sent to the test department, where all repairs are checked and a load test is made and recorded before releasing for use. All repair work and used motors are guaranteed for a period of one year, and with careful inspection we have not found this guarantee in any way a burden.

In addition to these facilities, the company maintains a specially trained crew of experienced motor men, always available day or night, for handling motor trouble calls, as in emergency cases our customers depend upon the company to make a complete job.

Central-Station Use of Main Street Display

THAT the electric service company which does not maintain an office or appliance salesroom in the shopping district is not thereby debarred from making effective displays on the main business street was recently proved by J. A. Hunnewell, manager of the Lowell (Mass.) Electric Light Corporation. The solution of the problem, says Mr. Hunnewell, is to rent a window when one is wanted for any special display or demonstration. The cost of such temporary space is small, and the direct return both to the service company and to the merchant whose window is utilized makes the proposition mutually attractive.

The Lowell Electric Light Company conducts sales campaigns periodically on all the major appliances and has been particularly successful with the sale of electric cleaners. Last October, by means of a rented main street display window, plus newspaper advertising and a limited amount of house-to-house canvassing by the company's regular sales crew of six men and one woman, eighty-five cleaners were sold at list price with no other inducement than a very low payment down. The previous month's sales had been fifty-six cleaners, in the

STOP
LOOK
LISTEN

Today at Kittredge's

Today or this evening when you are downtown be sure and stop at Kittredge's Stationery Store, 15 Central Street, to see our remarkable window demonstration of the ROYAL Electric Cleaner

Two special factory representatives have been busy all day yesterday and will be engaged today in entertaining the Lowell public by means of a window showing that is unique and different from anything you have ever before seen.

This display concludes our October Club Offer, whereby you can purchase a ROYAL for Only $1.00 Down, $1.00 Weekly. Spend a few moments watching the demonstrators and you will no longer wonder at the ROYAL popularity

Open until 9 P. M.

The Lowell Electric Light Corporation

29-31 Market St. Tel. 621

NEWSPAPER ANNOUNCEMENT OF SPECIAL WINDOW DISPLAY

month following the campaign more than fifty were sold, and in the three days before Christmas twenty-six, which indicates that the special effort was neither a "cashing in" on an accumulated demand nor did it "milk" the territory dry of prospective customers.

The idea of using a borrowed or rented window gives particularly good results in Lowell, but there appears to be no reason why it should not be equally effective elsewhere—provided the same care is given to details. Mr. Hunnewell, after ar-

CROWD WATCHING CENTRAL-STATION COMPANY'S DEMONSTRATION IN RENTED WINDOW

ranging for the display space, obtained the services of two expert window demonstrators from the Royal factory, manufacturer of the cleaner which was being sold, thus insuring an interesting and effective presentation of the machine, and he then attracted wide popular interest by inserting liberal newspaper announcements of the event.

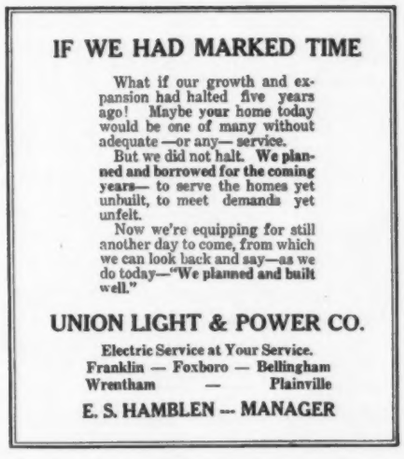
The result of this forethought was a crowd which blocked the sidewalk in front of the window most of the time from mid-morning, when the demonstration began, until 9 or 10 o'clock each evening. The photograph reproduced shows the caliber of the people attracted, but a further evidence of the practical success of the plan is the fact that in the three days' demonstration six sales were completed on the spot and a large number of "prospects" secured. In considering this result it must be understood that Lowell is what is known to outsiders as a "mill town," and that the textile industry has not been going very well in recent months; also, Lowell has a very considerable foreign population, among whom the expenditure of $65, even on easy terms, is an important fiscal operation.

It is fair to estimate that the special window display described and its attendant advertising resulted directly in not less than thirty extra sales of cleaners, which, in a city of the size and type of Lowell, may be considered as a very fair return for both the expense and the effort that were involved.

Advertising the Value of a Utility's Service

OVER the signature of E. S. Hamblen, manager of the Union Light & Power Company, Franklin, Mass., a variety of newspaper advertisements recounting interesting phases of public utility work as it affects service have lately been used with very good results in that organization's territory. "Most of these advertisements," says Mr. Hamblen, "tie in with some local event or something that a customer has said. I believe this form of advertising is a great asset to the electric light company, as the majority of us do not tell the public enough about our business, and those of us who do are apt to give a lot of figures which mean nothing to the public and which, therefore, are naturally thrown into the waste basket.

"It is interesting to know that last fall when daylight saving ended we sent out a signed notice calling attention to the fact that daylight saving was no longer with us; that bills would therefore be higher, but that if the customer still felt, after taking this into consideration, that his bill was too high, he should not hesitate to call upon us. This little notice cut down our complaint tests by almost 90 per cent as compared with the previous year for the months of November and December."


IF WE HAD MARKED TIME
What if our growth and expansion had halted five years ago! Maybe your home today would be one of many without adequate —or any— service.
But we did not halt. We planned and borrowed for the coming years— to serve the homes yet unbuilt, to meet demands yet unfelt.
Now we're equipping for still another day to come, from which we can look back and say—as we do today—"We planned and built well."
UNION LIGHT & POWER CO.
Electric Service at Your Service.
Franklin — Foxboro — Bellingham
Wrentham — Plainville
E. S. HAMBLEN — MANAGER

GOOD-WILL ADVERTISEMENT DISCUSSING UTILITY BUSINESS

THE MAN ON THE STREET

Sometimes "kicks" about his electric light bill. Why? Because he cannot see the kilowatt-hours. Compare your lighting bills with other expenses—in many cases more money is spent for reading matter than for the electric light bill, even where several appliances are used every day.

What is Service worth to you? After all, that is what we sell.

CIGARS

A cigar is a far cry from electric service, yet a five-cent cigar a day represents more than the difference in cost of the lowest rate for lighting in the large cities of Massachusetts and ours if the consumer uses 30 kilowatt-hours a month, and this is far greater than the average consumption of our customers.

What is Service worth to you?

A MAN

Honest in his opinion, stated that I was wasting this Company's money in telling the Public what we are trying to do, YET we are all told every week about a certain pure soap that floats, and I believe that the soap would have sunk long ago if the manufacturers had not been wise enough to keep on telling us all about it.

At Your Service Always.

DID YOU EVER STOP TO THINK

That the cost of living has gone up 72 per cent since 1913? Yet our rate for house lighting is one cent less in spite of the fact that we have spent thousands of dollars in improving our service and extending our lines to take care of customers on the outskirts.

At Your Service Always.

TEXT OF TYPICAL "ADS" USED BY UNION LIGHT & POWER COMPANY

Industrial-Heat Lectures Popular in Chicago

NEARLY one hundred engineers, representing central stations, equipment manufacturers and users of electric power and heat, attended the first of a series of industrial-heating lectures sponsored by the Public Service Company of Northern Illinois and the Commonwealth Edison Company at Chicago. These lectures were originally planned to assist central-station power and heating engineers in the development of industrial heating loads. The users of electric power and heat were also invited to send representatives to learn about the proper utilization of electric heating and the interest of heat users was shown by the fact that they constituted 30 per cent of the total attendance at the lecture.

Wirt S. Scott, manager industrial heating division, Westinghouse Electric & Manufacturing Company, cited results of studies that showed the return on the power company's investment in plant capacity to care for electric heating load to be greater than that received for other classes of business. These studies showed the return on plant investment to be as follows: Residence lighting, 3.3 per cent; commercial lighting, 9.9 per cent; street lighting, 9.1 per cent; industrial power, 10 per cent; industrial heating, 14 per cent.

A. H. Vaughn, chief application engineer Electric Furnace Company, Salem, Ohio, pointed out the necessity of considering comparative cost of industrial electric heating and other forms of heating on the basis of the over-all cost of the finished article. A representative of the Federal Electric Company told of his company's satisfactory experience in the use of the electric furnace for vitreous enameling.

Subsequent meetings were equally successful and well attended. The meetings were in charge of J. D. Haynesworth, industrial heating specialist for the Public Service Company of Northern Illinois, and C. H. Stevenson of the industrial heating bureau, Commonwealth Edison Company and were held in the rooms of the Western Society of Engineers.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Turbines for River Rouge Plant.—The first of eight units in a plant which is to have an aggregate rating of 300,000 kw. and to serve exclusively the Ford industries and railroad has been put into operation. The turbine is of the impulse type, designed to develop a maximum of 62,500 hp. at 1,200 r.p.m. with steam at 250 lb. and 250 deg. F. superheat and a vacuum of 29.5 in. The unit is described in considerable detail, with cuts showing constructional features of the turbine itself and the governor, regulating valve and stop valve.—*Power*, Jan. 20, 1925.

Mercury-Vapor Process.—W. L. R. EMMET.—The effort to increase the efficiency of the thermodynamic process using water as a working fluid leads to very high pressures, superheating and reheating. Water has a pressure of 3,200 lb. per square inch at 706 deg. F., and cannot exist as a saturated vapor at any higher temperatures. As it approaches this critical temperature its latent heat of vaporization progressively diminishes and the heat in the liquid increases. Mercury boils at 677 deg. F. with atmospheric pressure, and t 706 deg. has a pressure of only 5 lb. above atmosphere. At 900 deg. its pressure is only 80 lb. above atmosphere. These properties are combined in the process which utilizes both fluids. The paper briefly describes the large-scale experimental equipment at Hartford, designed to operate with 35 lb. gage pressure on the mercury boiler and to deliver about 1,800 kw. from the mercury turbine. If this process can be developed to thoroughly workable conditions, the gain in output per pound of fuel should be from 50 to 60 per cent over that in the best existing steam-power stations. — *Journal of Franklin Institute*, January, 1925.

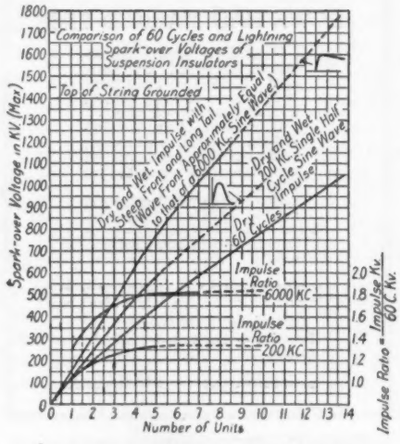
The Steam Turbine as a Study in Applied Physics.—SIR CHARLES A. PARSONS.—The author outlines the steps by which improvements in the use of steam for power have been brought about since the time of Watt, the earlier stages of invention demanding a broad knowledge of physics, whereas later refinements come with a more accurate study of materials and the application of higher mathematics. As to the steam turbine, four ways are mentioned of increasing the efficiency of the thermodynamic cycle without exceeding a temperature of 750 deg. F. In this connection a table is given showing estimated over-all thermal efficiencies attainable by increasing boiler pressures, from which the accompanying items are taken. Oil is assumed to be the fuel.—*Journal of Franklin Institute*, January, 1925.

ESTIMATED OVER-ALL THERMAL EFFICIENCIES ATTAINED BY INCREASING BOILER PRESSURE

Stop-Valve Pressure, Lb.	Thermal Efficiency, Steam to Electricity	Over-All Thermal Efficiency, Fuel to Electricity	Per Cent Reduction in Fuel Consumption	Equivalent Lb. Oil Per Boiler-Hp.-Hr.
250	31.6	26.52	.....	0.501
500	33.5	27.97	5.45	0.475
1,000	35.2	29.20	10.08	0.455
1,500	36.6	30.20	13.82	0.440
2,000	37.5	30.75	15.90	0.432

Transmission, Substations and Distribution

Lightning.—F. W. PEEK, JR.—The author undertakes to give as close an approximation as available data will permit of the voltage and characteristics of lightning, as well as the effects of lightning on transmission lines, line insulation, lightning rods, etc., based on observations on existing lines and on experiments with the "lightning generator." The data include tables of lightning voltages on transmission lines as related to the height of the towers, duration and frequency of a lightning discharge from a 24-mile transmission


Comparison of 60 Cycles and Lightning Spark-over Voltages of Suspension Insulators
Top of String Grounded
Dry and Wet Impulse with Steep Front and Long Tail (Wave Front Approximately Equal to that of a 6000 KC Sine Wave)
Dry and Wet 200 KC Single Cycle Sine Wave Impulse
Dry 60 Cycles
Impulse Ratio 6000 KC
Impulse Ratio 200 KC
Spark-over Voltage in KV. (Max)
Impulse Ratio = Impulse Kv. / 60 C. Kv.
Number of Units

SPARKOVER VOLTAGES FOR MODERN SUSPENSION INSULATORS

line, effect of ground wire with various arrangements, effects of resistance and reactance in the "ground" and on the area protected by a lightning rod. It is found that the maximum possible voltage gradient during a lightning storm is about 100 kv. per foot, which value would determine the voltage induced if the line were directly under a cloud charged to a sufficient voltage to discharge it to earth or line. For the majority of storms the gradient will be much lower. A comparison of 60-cycle and lightning sparkover voltages for modern suspension insulators is made in the accompanying illustration. From another chart it appears that a 220-kv. line with a favorably installed ground wire is not likely to have trouble from lightning under any circumstances.—*Journal of the Franklin Institute*, February, 1925.

Compensated Three-Phase Cables.—A paper read by A. M. Taylor before the Junior Institute of Engineers, England, is abstracted in this issue. It deals primarily with the advances made in connection with the triple-concentric cable designed for use with the hexaphase system previously described.—*Electrical Review (England)*, Jan. 23, 1925.

Generation, Control, Switching and Protection

Automatic Horn-Type Air-Break Switch.—M. VOGELSANG. — Transformers of small and medium capacity installed at the end of branch lines, with voltages not over 30,000, require an automatic oil switch on the high-tension side, the cost of which is frequently out of proportion to the rest of the installation. Experiences with high-voltage fuses instead of breakers were discouraging. It was for this reason that the author, who is connected with a large switch concern, developed a very inexpensive air-break switch of the horn type with which excellent results have been experienced, more than 2,000 being in practical service. The two main horns are stationary with a movable contact between them which pulls the arc in opening from one horn to the other. A small magnetic trip coil, placed directly in the high-voltage path, opens the switch on an overload or a short circuit. A retarding mechanism disregards momentary overloads. The trip coil is so connected that it short-circuits its own winding at the instant of tripping so that the coil is not affected by the opening arc. Extended tests with this switch showed that, although it is designed only for small opening currents, it stood up remarkably well when breaking a circuit of 6,000 volts at 380 amp. Oscillographic records of the break disclosed a breaking period of 28 cycles or about half a second. In the author's opinion a well-designed air-break switch could compete successfully with an oil switch, and he predicts that designers of high-voltage switchgear may ultimately come back to the air-break type of switch.—*Elektrotechnik und Maschinenbau*, Jan. 25, 1925.

Efficiency Test of a 15,000-kw. Turbo-Generator.—J. E. WOODWELL.—A unit at the Lansing (Mich.) municipal power plant built for 250 lb. steam pressure and 200 deg. F. superheat was officially tested at various loads in two-hour periods. The article gives a tabulated summary of the results. The actual steam consumption and the corresponding guaranteed values were as shown in the table.—*Power*, Jan. 27, 1925.

Load — Nominal	Load — Actual Kw.	Water Rate per Kw.-Hr., Lb. — Test	Water Rate per Kw.-Hr., Lb. — Guarantee
One-quarter load	3,823	12.94	13.44
One-half load	7,582	11.03	11.38
Three-quarter load	11,268	10.33	10.66
Most economical load	13,860	10.16	10.52
Full load, 80 per cent power factor	15,005	10.30	10.59
Overload, 1,000 kw., 85 per cent power factor	16,270	10.40	10.70

Effect of Oxidation on the High-Frequency Resistance of Aërial Wires.—L. B. TURNER.—Measurements were made at various wave lengths on thick, solid and stranded wires to ascertain the effect on their high-frequency resistance of the oxide film formed by weathering. Two methods were used, each involving an oscillating circuit—(a) resistance variation and (b) capac-

itance variation (Bjerknes). No appreciable effect was found.—*Journal of I. E. E. (England)*, January, 1925.

Units, Measurements and Instruments

Iron Losses in Direct-Current Machines.—EDWARD HUGHES.—An experimental investigation was conducted covering the range of conditions existing not only in the armature core but also in the teeth and including the alloys as well as ordinary soft iron laminations. No-load conditions and the increase of loss with load were both studied. The results are given in detail, with charts, and lead the author to these general conclusions; among others: (a) In a direct-current machine the hysteresis loss varies as B^x, where x lies between 1.6 and 1.8, and the eddy-current loss varies as B^y, where y lies between about 2 and 2.4, being generally greater than 2. (b) The hysteresis loss in a toothed armature does not show any sign of decreasing with increasing flux densities of the values generally employed in armatures. (c) More consistent values of the exponents of B and f are obtained from the total iron loss than from the hysteresis and eddy-current losses separately, and the total iron loss can be calculated with fair accuracy over wide ranges of frequency and of flux density. Definite conclusions are also reached as to load losses in commutating-pole machines.—*Journal of Institute of Electrical Engineers (England)*, December, 1924.

Theory of Probability and Some Applications to Engineering Problems.—E. C. MOLINA.—In telephony the theory of probability has been utilized for more than a quarter of a century. The author holds that it could advantageously be applied to many other engineering problems. Accordingly, the fundamental principles are stated, with simple illustrations, and applied to three problems chosen from the field of telephone engineering.—*Journal of A. I. E. E.*, February, 1925.

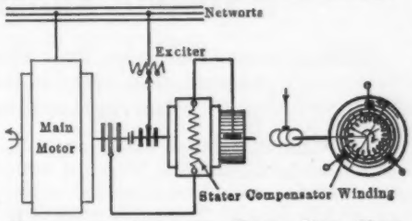
Electrophysics, Electrochemistry and Batteries

Effect of Stress on the Magnetic Properties of Steel Wire.—R. L. SANFORD.—The author describes an investigation on non-destructive methods of testing wire rope. Data are given in terms of magnetic reluctivity, showing the effect of stress on the magnetic properties. It is found that the reluctivity, which is a linear function of the magnetizing force for pure homogeneous materials, no longer shows such a linear relationship when tension is applied to the wire. It is shown how two components of the material differing only as regards stress condition and each following the linear relationship can be combined to give the results found by experiment. This method of analysis seems to be capable of further development and extension into other fields of magnetic analysis.—*Scientific Paper No. 496 of the Bureau of Standards.*

Theory of the "Schroteffekt."—T. C. FRY.—The space current in a vacuum tube is a migration of discrete particles, not the steady flow of a continuous fluid. If some other fluctuation, such as an attenuated telephone message, were superposed on it and the whole sufficiently amplified by a perfect amplifier, the signal would be noisy to a degree depending upon the relative amplitudes. Thus there is a lower limit of intensity below which electrical signals cannot be detected by vacuum tubes because of the lumpiness of the space current in the first tube. This leads to the study of a phase of electron emission to which other investigators have given attention and which the author discusses physically and mathematically in the light of various hypotheses.—*Journal of Franklin Institute*, January, 1925.

Motors and Control

Three-Phase Exciter Machine.—J. KOZISEK.—To improve the power factor of induction motors without losing their desirable asynchronous character, so-called exciter machines are being used in connection with these motors the purpose of which is to supply the necessary compensation of the wattless magnetizing current. As this is done from the rotor side of the motor, the exciting machine is really a frequency changer, furnishing current at slip frequency. The first exciter machines were built with self-excitation and were driven by an auxiliary motor. Such an arrangement was successful only during the full-load periods of the main motor. At partial load its benefit was small, at no load it was zero, and at negative load—that is, over synchronous speed, when operating as generator—it made conditions worse, unless suitably reconnected. The new, externally excited and directly driven exciting machine described in this paper is a great improvement over the original type. It consists of a direct-current armature with commutator and three collector rings and a small stator with three compensating phases, as shown herewith. A special arrangement of this compensating stator winding results in a very satisfactory commutation, giving an unusually long life to commutator and brushes. If direct connection between main motor and exciter be not possible, either the two must be geared together or chain drive must be used. The size of the exciter is the same as for a synchronous motor; that is, it has to be so dimensioned as to supply the losses of the exciting machine itself and furnish the excitation of the main motor. This new type of compensator fulfills its purpose automatically under any load condition, wherein it differs materially from the old self-excited type. — *Elektrotechnische Zeitschrift*, Jan. 29, 1925.



EXCITATION MACHINE THAT HAS VERY SATISFACTORY COMMUTATION CHARACTERISTICS

Principles and Applications of Thermostats.—P. A. RICCIO.—A thermostat mechanism and the sensitive element. In a room thermostat both the sensitive element and the mechanism are placed in the room where the temperature is to be controlled, making all parts of the thermostat accessible. There are many places where temperatures are to be regulated that are not easily accessible and in some cases not accessible at all; for instance, hot-water tanks, or other receptacles containing liquids, hot-air ducts, baking ovens for enamels and Japans, sterilizers and pasteurizers, etc. The author describes the various types of thermostats in use and then points out their application to the work mentioned above.—*National Engineer*, February, 1925.

Electric Motor Drive for Centrifugal Compressors. — GORDON FOX. — The author presents a general discussion of this type of a centrifugal fan, with tables of power requirements and characteristic curves.—*Blast Furnace and Steel Plant*, January, 1925.

Telegraphy, Telephony, Radio and Signals

Carrier Telephony on Power Lines.—This discussion of a paper presented at the A. I. E. E. spring convention contains transmission-line and transformer impedance curves for frequencies up to 80 kilocycles. A report of the convention may be found in the ELECTRICAL WORLD for April 19, 1924. —*Journal of the A. I. E. E.*, January, 1925.

Alternating-Current Cable Telegraphy.—L. A. MACCOLL.—This is a criticism of the mathematical treatment and certain of the conclusions reached by Cohen in a paper published in the *Franklin Journal*, February, 1923, in which he disagrees with parts of Malcolm's book on "The Theory of the Submarine Telegraph and Telephone Cable." The present author finds that Cohen, rather than Malcolm, is in error.—*Journal of the Franklin Institute*, January, 1925.

Voltage Amplification Ratio of the Triode Valve Resistance Amplifier.—H. NUKIYAMA and T. KUWASHIMA.—The voltage amplification ratio of the triode valve resistance amplifier is measured in the audio-frequency range by means of an alternating-current potentiometer. The relation between amplification ratio and resistance in the plate circuit and the amplitude of the impressed alternating voltage at the grid has been studied experimentally. It is observed that in an amplifier which has a grid condenser the grid average voltage is affected to a great extent by the input grid alternating potential due to the rectifying action, and this will cause a change in the amplification ratio owing to the change in the amplitude of the input grid alternating potential. From the static characteristics with the resistance in the plate circuit, which is called the resistance static characteristics, all the dynamical phenomena are explained.—*Technology Reports of the Tohuku Imperial University, Sendai Japan*, Vol. IV, No. 3.

News of the Industry

Priest Rapids Gets License

Columbia River Project Rated at 750,000 Hp. Ultimate—Applications for Permits

A LICENSE covering the Priest Rapids project of the Washington Irrigation & Development Company was authorized at a meeting of the Federal Power Commission held March 2. The license covers a 750,000-hp. ultimate development in the Columbia River. The dam is to be 2½ miles long and will form a reservoir with a storage capacity of 85,000 acre-feet. The dam will be composed of an earth-fill section at each end, a concrete spillway section, a power-house section and a concrete gravity section having fishways, an ice chute and a lock entrance to provide for possible future navigation facilities. The primary power available at the site is 201,000 hp. The initial installation will be 340,000 hp.

At the instance of the Chief of Engineers the license is to carry conditions governing investigation as to the plans for the dam and the selection of its site, the preservation and protection of navigation facilities, the protection of fish (up to an expense of $300,000), the rights of irrigation projects to use of the waters, the maintenance of rights granted to the Hanford Irrigation & Power Company, which obtained a permit from the Secretary of War in 1906, and the determination of legitimate cost and investment by the commission.

The Missouri Hydro-Electric Power Company, with headquarters in Kansas City, has asked the commission for a preliminary permit for a power installation on the Current River in Ripley, Carter and Shannon Counties, Mo. The company desires to build dams at Hargus Eddy, Bass Rock and at a point about 10 miles below the mouth of Jack's Fork. Company experts have estimated there will be available at these points 2 per cent of the time a total of 56,000 hp. and that this can be increased 25 per cent by contemplated storage reservoirs.

The Logan City Corporation has applied for a license for a constructed project on Logan River, near Logan City, in Cache County, Utah, having a primary capacity of approximately 1,200.

Thebo, Starr & Anderton have applied for a preliminary permit for an installation on Long, Crater and Sweetheart Creeks and Speel River, approximately 30 miles southeast of Juneau, Alaska, within the Tongass National Forest. The types of the structures have not yet been determined. A preliminary estimate of the amount of power which may reasonably be produced is 104,500 continuous horsepower.

Protection of Applicants' Data

Stream-flow and other data which have been compiled by an applicant under the water-power act will not be turned over to another applicant for the same rights even if the rights granted the first applicant should be allowed to lapse. A decision to this effect was rendered recently when an applicant for a preliminary permit was not in position to apply for a license after his permit had been extended to the legal limit. A prospective applicant for a preliminary permit covering the same power site took the position that he should not be required to undergo the expense incident to duplicating the information already in the hands of the commission.

The data will be turned over to the new applicant if the former applicant definitely abandons the project. In most cases, however, the earlier applicant expects later to qualify for license. Even if a preliminary permit were granted to another, the chance would exist that he might not be in a position to qualify for a license at the expiration of the permit, whereupon the original applicant could step in and qualify.

Congress Authorizes Four-State Columbia Compact

On Wednesday, March 3, just before the expiration of the Sixty-eighth Congress, a bill previously passed by the Senate was adopted by the House of Representatives of which the purport is "to permit a compact or agreement between the States of Washington, Idaho, Oregon and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries and for other purposes." This treaty, which is to be entered into not later than January 1, 1927, will cover irrigation, power, domestic and navigation uses of the river's waters. There is no reason to doubt that the President will sign the bill.

Muscle Shoals Bill Expires

Both Houses, However, Pass Resolution Calling for a Presidential Commission and Coolidge Is Likely to Assent—Norris Has Interstate Rate Plan

CONGRESS fulfilled recent expectations by adjourning March 4 without having taken constructive action on Muscle Shoals. The conference committee of the two houses, to which, as reported last week, the Muscle Shoals bill was recommitted, on the sustained objection of Senator Norris that it had come out of the committee with new matter included, quickly brought in a new report, which was all but identical with the Underwood bill as originally submitted to the committee. It was apparent that its consideration by the Senate simply would provoke a filibuster that would displace other legislation which had a chance to pass, and for this reason no effort was made in that body to call up the final report of the conferees; nor was any action on it taken in the House.

Congress Urges Commission

A resolution moved by Representative Madden and adopted by the Lower House declared it to be the sense of that body that the President should create a commission of three members to report on the "best, cheapest and most available means for the production of nitrate" at Muscle Shoals, this commission to comprise a representative citizen familiar with the Muscle Shoals enterprise, a representative of agriculture versed in the use of commercial fertilizers and a chemical engineer versed in the methods of air nitrogen fixation. It also was resolved "that it is the sense of the House that the value of the nitrate plants to agriculture depends upon the supply of cheap water power from the Wilson Dam, and that as a protection to the farmers this power should not be disposed of for other purposes until Congress shall have taken action upon the recommendations of the President."

At the eleventh hour on Wednesday morning the Senate passed, on the motion of Senator McKellar of Tennessee, a separate resolution for the appointment of a presidential commission, this resolution being clearly designed to support the action of the House and give it the virtual effect of a joint resolution of Congress making a request upon the President.

The effort to deny the power to the people of the South and to cause the government to forego the revenues which can be obtained by its sale, pending action by Congress, is thought to have been inspired by certain local interests who have their own preconceived ideas as to the proper disposition of the properties and the power output. A resolution of this character has no legal weight. At the same time, the President has told his callers that when the House resolution reaches him he is inclined to give it a favorable reception; in other words, he intends to appoint the commission.

Southern Companies May Get Power

Its appointment will not mean, however, that the power will be allowed to run to waste. To begin with, the Sheffield steam plant is already under lease to the Alabama Power Company at a rental of $250,000 a year and could not be affected. Moreover, the national de-

fense act—a law in due form on the statute books—directs the sale, wherever possible, of surplus property and products. In view of the mandatory language of that statute it is not expected that the Secretary of War, the custodian of the government's Muscle Shoals properties, will allow the power to go to waste throughout an indefinite period during which Congress is making up its mind as to the final disposition of the property. It is therefore likely that negotiations for the temporary use of the power will be begun soon between the Secretary of War and the representatives of the associated Southern power companies.

PRESIDENT AND PUBLIC OWNERSHIP

President Coolidge in his inaugural address said that proposals for government ownership of railroads and "certain electric utilities" had met with complete defeat at the last election and by inference pledged himself against government ownership or operation of Muscle Shoals or any other public utility.

Some of those who are averse to the distribution of Muscle Shoals power in the seven Southeastern states served by the systems of the associated companies, on the ground that once the power has been distributed it will not be possible to get it back in order to experiment with fertilizer production, charge Secretary of War Weeks with undue eagerness to turn the power over to the companies. It is understood at Washington, however, that Secretary Weeks will leave the Cabinet in June and thus will have no controlling voice in the disposal of the energy when the Wilson Dam plant comes in next August or September.

SENATOR NORRIS' NEW BILL

Senator Norris introduced a bill to amend Section 20 of the water-power act so as to give the Federal Power Commission jurisdiction over the rates for interstate business of plants licensed by it. No action was taken on this bill, which will probably be introduced again when the new Congress assembles.

Associated Gas Acquires Fourteen New York Plants

Small utility companies which have operated in Ridgefield, Conn., and Katonah, Bedford, Croton Falls, Mahopac, Brewster, Cornell, Pawling, Wingdale, Dover Plains, Amenia, Copake and Chatham, N. Y., serving about eight thousand customers near the Connecticut and Massachusetts border, have been acquired by interests affiliated with the Associated Gas & Electric Company, New York, and permission has been asked of the Public Service Commission to group them in a compact operating company to be known as the Harlem Valley Electric Corporation, with headquarters at Brewster. They will be connected by transmission lines.

The same interests have acquired in the western part of the state adjacent to Buffalo the Depew & Lancaster Light, Power & Conduit Company and the electric system formerly owned by the Iroquois Utilities Company, serving about 10,000 consumers from Clarence, east of Niagara Falls, south to Depew, Lancaster and East Aurora, and through the territory of the Iroquois Utilities Company, which includes Gowanda, Randolph and other localities. Application has been made to authorize the Depew & Lancaster company to acquire the property of the Iroquois Utilities Company.

The Associated Gas & Electric utilities are under the supervision of the J. G. White Engineering and Management corporations.

Fleishhackers Quit Light and Power Field

Sale of Northwestern Electric Company of Portland, Ore., to American Power & Light Is Announced—New Hydro Plant to Be Built

ANNOUNCEMENT that interests associated with the American Power & Light Company of New York have purchased the entire outstanding common stock of the Northwestern Electric Company of Portland, Ore., indicates the retirement from the electric light and power field of the Fleishhacker brothers, who had long been prominent figures in the banking and public utility world of the Pacific Coast. It will be remembered that Mortimer Fleishhacker was president and Hubert Fleishhacker vice-president of the Great Western Power Company of San Francisco until the sale of their stock last December to the Western Power Corporation of New York, which now controls the company just named. The position of the brothers was reversed in Portland, Hubert Fleishhacker being president and Mortimer vice-president of the Northwestern Electric Company.

This company operates a hydro-electric station at Underwood, Wash., with a capacity of 15,000 kw., and two steam stations at Portland rated at 25,000 kw. It also purchases energy from the Pacific Power & Light Company. The latter company, which also is controlled by the American Power & Light Company, has steam generating stations at Astoria, Ore., and Walla Walla, Kennewick, Pomeroy and Naches, Wash., and hydro-electric stations at Tygh Valley and on Hood River and Walla Walla River, Ore., and at Yakima, Goldendale, Husum and Naches, Wash. The Northwestern Electric Company has an outstanding capital of $2,671,000 in preferred and $10,000,000 in common stock and $6,820,500 in bond issues. On January 1 it had a connected load of 75,000 kw. and a peak load of 32,000 kw. It serves about 23,000 customers and the Pacific Power & Light about 36,000, against 72,000 served by the Portland Electric Power Company.

TO BUILD NEW PLANT

Management and operation of the Northwestern Electric properties will be under the control of the Pacific Power & Light Company and will remain as it is for the present, Guy W. Talbot, president of the Pacific Power & Light Company, informed a representative of the ELECTRICAL WORLD in San Francisco this week. With the later amalgamation of the two systems, the transmission lines of the Northwestern company, already tied in with those of the Pacific company at Hood River, Ore., will be connected with the latter's transmission network in eastern Washington and Oregon. The construction of this line and the development of a major power site on either the Lewis or the Deschutes River will be among the early undertakings of the combined systems. Mr. Talbot said further that all of the common stock of the Northwestern company was taken in at $48 a share.

The American Power & Light Company, for which the Electric Bond & Share Company is fiscal agent, numbers among its subsidiaries the Kansas Gas & Electric Company of Wichita, the Miami Beach Electric Company of Florida, the Minnesota Power & Light Company of Duluth, the Nebraska Power Company of Omaha and the Southwestern Power & Light Company, which itself operates through subsidiaries various utility companies in Texas.

New Jersey Delays Ratification of Delaware Treaty

The treaty negotiated between New York, New Jersey and Pennsylvania for the apportionment of the waters of the Delaware River between the three states (see ELECTRICAL WORLD, January 31, page 269) has been approved by the New York Assembly and the Philadelphia Legislature, but has been delayed in New Jersey, where the Senate has decided to adopt a resolution providing for a commission of experts to study the state's entire water supply problem and report to the next Legislature. Five amendments have been proposed by the New Jersey Senators and all have been accepted by New York and Pennsylvania. The New Jersey Senate, however, insists that the matter shall rest for another year.

Insull on Chicago's Vote to Buy Surface and "L" Lines

At an election held on February 24 the citizens of Chicago voted to authorize the purchase of the city's surface and elevated lines, building of elevated extensions, laying of more surface tracks, purchase of several thousand new cars and digging of subways. Samuel Insull, president of the Commonwealth Edison Company, at the annual meeting of the company, in an address which was broadcasted by radio, said: "I myself have not much belief in a scheme of shifting responsibilities from individual management to municipal management, but so urgent is the necessity that I, in the capacity of representing the millions of dollars invested by this company, care not what the scheme may be so long as it contemplates co-ordination of local transportation facilities in this city and a development of rapid transit in the largest sense of the word. For the last thirty years transportation has been too much a question of politics and too little a question of transportation."

California Edison Appeals

Injunction Against Storage Will Be Fought—Construction to Go on Unabated

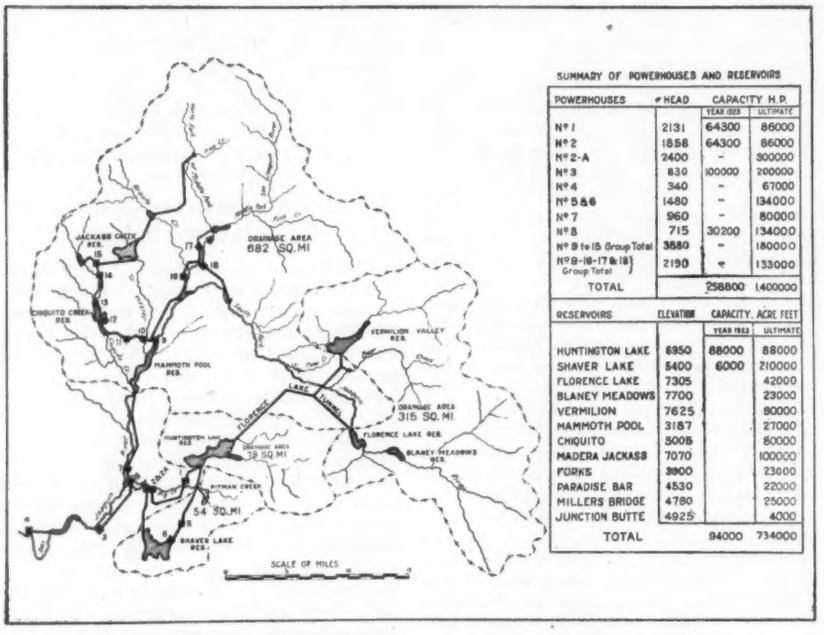
BY AN opinion of the Superior Court of Fresno County, Cal., filed on February 13, and reported in the ELECTRICAL WORLD for February 21, page 419, the Southern California Edison Company has been enjoined from storing water in Huntington Lake on its Big Creek hydro-electric project except that which is produced by the run-off in the Huntington Lake basin. This in effect means that water stored in the Florence Lake, Vermilion Valley and Blaney Meadows reservoirs on the so-called east side development cannot be carried through the recently completed Florence Lake tunnel and held in storage in Huntington Lake or Shaver Lake for use through the chain of Big Creek power houses—now numbering four, with an aggregate capacity of 238,000 kw.—but must be allowed to flow on into the San Joaquin River so that the normal flow of that stream will be unaffected.

The decision in like manner prevents the storage of water along the Middle Fork of the San Joaquin on the west side development, as yet not undertaken. The Herminghaus heirs, owners of a tract of land along the San Joaquin River in the valley, brought suit against the power company under the name of Mrs. Amelia Herminghaus on the ground that the storage of water for power purposes on the upper reaches of the river prevents the normal spring floods from overflowing the lowlands of the estate and replenishing the supply of ground water necessary to the use of the land, thus interfering with the riparian rights of the estate.

One of the main points of contention of the power company was that as lessees of water rights from the federal government it was entitled to the riparian rights of the government in the public domain. Superior Judge Woolley agreed with this contention, but he held that the storage of water for the generation of power was not an incident of riparian ownership. It was the opinion of irrigationists in the San Joaquin Valley that the storage of the spring run-off in the mountains was both necessary and beneficial because such floodwaters have no present or future beneficial use to riparian owners in the lowlands. In the opinion of J. F. Truesdell, assistant to the Attorney-General, appearing for the government, the government has the power as riparian owner of the public domain to store waters from a wet to a dry season.

John B. Miller, president of the Southern California Edison Company, has announced that the case will be immediately appealed and that work will continue in the meantime on the Big Creek-San Joaquin hydro-electric development along the lines originally intended by that company. This means that construction work will continue on the Florence Lake Dam and upon such other units of the project as had been contemplated for 1925.

In the opinion of lawyers versed in water law who have followed the case, condemnation proceedings will have to be resorted to by the Edison company if the decision is upheld in the higher courts.



SUMMARY OF POWERHOUSES AND RESERVOIRS

POWERHOUSES	↵ HEAD	CAPACITY H.P. YEAR 1923	CAPACITY H.P. ULTIMATE
N° 1	2131	64300	86000
N° 2	1858	64300	86000
N° 2-A	2400	-	300000
N° 3	830	100000	200000
N° 4	340	-	67000
N° 5 & 6	1480	-	134000
N° 7	960	-	80000
N° 8	715	30200	134000
N° 9 to 15 Group Total	3580	-	180000
N° 9-16-17 & 18 Group Total	2190	-	133000
TOTAL		258800	1400000

RESERVOIRS	ELEVATION	CAPACITY, ACRE FEET YEAR 1923	CAPACITY, ACRE FEET ULTIMATE
HUNTINGTON LAKE	6950	88000	88000
SHAVER LAKE	5400	6000	210000
FLORENCE LAKE	7305		42000
BLANEY MEADOWS	7700		23000
VERMILION	7625		80000
MAMMOTH POOL	3187		27000
CHIQUITO	5005		80000
MADERA JACKASS	7070		100000
FORKS	3900		23000
PARADISE BAR	4530		22000
MILLERS BRIDGE	4780		25000
JUNCTION BUTTE	4925		4000
TOTAL		94000	734000

STORAGE PROJECTS ON SAN JOAQUIN AFFECTED BY COURT DECISION

Financiers Pass First Through Florence Lake Tunnel

First to pass from end to end through the 13½-mile tunnel which connects Huntington and Florence Lakes in the High Sierras and, as already reported, has just been completed by the Southern California Edison Company as a part of its Big Creek hydro-electric development on the San Joaquin River were a score of prominent financiers from San Francisco, Los Angeles, Chicago, New York and other cities. These men made the trip under the escort of President John B. Miller of the Southern California Edison, and George Clinton Ward, vice-president in charge of construction, on February 22, four days after the east and west ends of the tunnel were joined. In the party were included presidents and other high officials of banking, industrial and manufacturing corporations. They expressed their gratification over the successful and early completion of the great undertaking in a complimentary letter to Mr. Miller, which concluded:

"While it is of course true that under public regulation the consumer will in the last analysis derive the benefit of the economy effected in building the Florence Lake tunnel, those who have invested in the stocks and bonds which have financed this and the other projects of the Southern California Edison Company are entitled to join us in this expression of appreciation. It means, in brief, that such portions of their investments as have gone into construction of the Florence Lake tunnel have produced a property of perpetual earning power, and at the reasonable rate of return fixed by the California Railroad Commission it will continue indefinitely to earn these returns. That this work has been completed so much sooner than any scientific calculations justified when it was commenced some four and a half years ago of course means that the property has been created at a much lower cost than was anticipated, which is an achievement in which both investors and consumers will benefit."

Vermont Association Meets

Radio Interference, Water Heating, Joint Use of Equipment and Power Factor Discussed

BEFORE the convention of the Vermont Electrical Association, held at Burlington on February 26, several matters of importance to the industry in that state were canvassed. At the business meeting in the afternoon the necessity for more nearly uniform practices in wiring methods and inspections was accentuated. Every utility and nearly every town were declared to have their individual requirements for wiring and service entrances, and President D. W. Jardine appointed a committee to study the matter of uniformity. Proposed legislation to tax hydro-electric development was condemned, and satisfaction was expressed because an attempt in the State Legislature to pass such a bill had aroused a public protest which brought about its overwhelming defeat.

In the evening the technical program was carried out, the papers being followed by discussion. L. W. W. Morrow and L. D. Snyder dealt with power-factor correction. A. H. Abbott pointed out the possibilities of industrial heating as a central-station load and outlined the developments in electric water heating and the real load that an electrified kitchen would give. R. J. Bennett told of the effect of radio on central stations, and many members related cases of radio interference troubles which the power company was

forced to clear even when it was not the source of the disturbance. F. L. Lovett gave an able paper on the working out of joint construction practice in Vermont and showed how to handle plant investments involved in joint use on a businesslike basis by actual interparty billing.

More than seventy-five representatives of Vermont utilities were present and reported that the outlook for utilities in that state during the coming year warranted optimism.

Employees' Home-Lighting Contest Arouses Emulation

Electric light and power companies in 567 towns and cities have registered for the National Electric Light Association's home-lighting contest for central-station employees, and many more have plans under way or have actually started to hold contests. Central-station employees in places where these contests are being conducted are showing keen interest in the prizes offered by the companies as well as in the national prizes, totaling one thousand dollars, offered by the N. E. L. A. These contests, as already explained in the ELECTRICAL WORLD, are an outcome of the home-lighting contest recently conducted by the Lighting Educational Committee among school children. By extending the contest to central-station employees the companies hope to improve vastly the knowledge of lighting among those whose work makes the possession of such information vitally important to them and those they serve.

Chicago leads the way by offering one hundred prizes. Fifty of these will be given to children of employees ten to eighteen years of age, and the other fifty to adults who are employees or members of employees' families. More than twenty-five hundred persons have registered for the contest in Chicago, which is being conducted by the Edison Club under the direction of Homer Niesz.

Cleveland is another town which is making efforts to get one of the national prizes. Thirteen local prizes will be offered to the employees of the Cleveland Electric Illuminating Company, ranging from the first prize of $25 down to a number of prizes at $5. Four prizes totaling $65 in cash are being offered to the employees of the Pennsylvania-Ohio Power & Light Company of Youngstown.

M. C. Huse of the Philadelphia Electric Company is in charge of the contest for his company, in which thirty-eight prizes, worth $125, are being offered. Judges of the Philadelphia contest are headed by Charles J. Russell, vice-president. Members of the lighting service division and others who are competent to grade the work submitted will examine all primers and will give each a rating. Many employees of the Kansas Gas & Electric Company at Wichita are competing for the twelve prizes offered by the company in the local contest. The Penn Public Service Corporation of Johnstown, Pa., will offer ten prizes in all, ranging from $25 to $5.

The above companies are only a few of those which have entered the employees' home-lighting contest. The date for submitting to the international judges at headquarters the winning primer from each company has been extended to May 1.

"Forbes Magazine" Offers Prizes to Electric Companies

For two years past *Forbes Magazine* has carried on essay-writing contests in connection with the convention of the National Electric Light Association in which the public have been invited to participate. This year, with the sanction of the N. E. L. A., the magazine will carry on a contest for the member companies themselves and award prizes for the best data and exhibits submitted. The awards will be given for the most constructive public relations campaign carried on by a light and power company in a local territory during the past year. The data to be submitted are to cover: (a) Plan of campaign and how conducted; (b) exhibits of all types of advertising and literature used; (c) record of achievement as shown by customer-ownership results, increased use of appliances and increased sales of light and power; (d) indicated growth of good will. The Judges will be Bruce Barton, Thomas F. Logan, Philip Thompson, publicity manager Western Electric Company; M. C. Forbes, editor *Forbes Magazine;* Louis Wiley, New York *Times,* and Ray Dickinson, *Printer's Ink.*

The contest opened on March 1, and exhibits, and papers must be in the office of the magazine, 120 Fifth Avenue, New York, by May 1. There are to be three awards. The winner, in addition to receiving a certificate of award, will be presented with a handsome cup. Appropriately engraved certificates awarding second and third prizes will be given to the two next best exhibitors. The three prize-winning exhibits and others will be taken to the San Francisco convention, where the award will be made.

Canadian Engineers Discuss Power Export

Long-Term Contracts with Provision for Several Years' Notice of Cancellation Advocated as Solution of Problem

ANIMATED debate over the proper policy to pursue in the exportation of power from Canada to the United States engrossed a crowded meeting of the Montreal Branch of the Engineering Institute of Canada on February 26. Great division of opinion was manifest and no vote was taken. Some of the engineers argued that a system of long-term contracts, with provision for several years' notice of cancellation, would overcome the danger, from the Canadian point of view, of power once exported never being recovered. Others argued that such contracts could never be canceled, so that the Canadian power would be permanently sent outside to help industries in the United States, possibly in years to come at the cost of Canadian industry.

ARGUMENTS PRO AND CON

Frederick W. Cowie, consulting engineer to the Montreal Harbor Commissioners, assuming a theoretical water-power development of 1,000,000 hp. near Montreal, said:

"In 1935 New England would readily buy at the busbars of this theoretical development 750,000 hp. at $14, allowing 50 cents each to the province and the Dominion to equal the Canadian price of $13. Transmission and distribution would bring the New England cost to $20, as against the Canadian price of, say, $14. There would still be an ample, cheaper power margin in favor of new industrial development in Canada for supplying overseas markets.

"It follows, therefore, that, vitally valuable to Canada as such a development would be, without export of power, thirty, forty or fifty years must elapse before it may be undertaken. With export, it would be an attractive, immediate, sound and economical proposition, and within our grasp."

C. J. des Baillets, chief engineer Montreal Water Board, argued that abundant and cheap power meant industry and employment. He compared export of Canadian power to a blood transfusion to help her competitors.

Fred B. Brown said Canada had ample power and raw material and Quebec had good labor, but the markets were shut off by tariffs. He argued for long-term export power contracts with provision for cancellation.

A. G. Pawson, manager of the Ottawa-Montreal Power Company, agreed that the sooner water power was harnessed the better, but thought the situation as to exportation of power fraught with danger. Henry Holgate took the opposite view, urging that with such restrictions as suggested by Mr. Brown power development for export would be a good thing which would not only utilize power at present running to waste but add to Canadian industry and increase the provincial government revenue.

Royal Le Sage said:

"Let us examine the case of the National Hydro-Electric Company, which proposes to develop 400,000 hp. at the Carillon dam, on the Ottawa River, and has asked for a permit to export 300,000 hp., reserving, under the control of the Railway Commission, 100,000 hp. to supply the Canadian demand. As the company is asking for a twenty-five-year license, it is understood, to export power, it is interesting to investigate what our power requirements will be in 1950 in order to ascertain whether Canada could spare the power which the company proposes to export. The power requirements of Ontario should be about 3,500,000 hp. in 1950, and those of Quebec probably somewhat under 3,000,000 hp. As these developments would only represent about 40 per cent of Ontario's available power, and in Quebec less than 20 per cent of the total possible power, it would seem as if these two provinces could very well spare the 300,000 hp. which the National Hydro-Electric Company desires to export."

Savings Banks Investments

Bill Which Will Widen Market of Utility Securities Now in Massachusetts Senate

PUBLIC utility operators, savings-bank officials, investment bankers and lawyers are keenly interested in a bill introduced into the Massachusetts Senate which would authorize savings banks of that state to invest in "certain public service companies" in addition to those already allowed. Under the existing law savings banks are allowed to invest in railroad bonds, traction or street railway bonds, telephone, gas, electric and water bonds, in addition to real estate mortgages and certain other classes of securities, all of companies, with the exception of the railroads, doing the major portion of their business in Massachusetts.

Additional fields of investment for diversification of funds and increased return on money invested have become of great importance and necessity to many savings banks, and years of study have convinced their officials that the bonds of public utility companies, as a class, with proper safeguards, afford desirable investment. This class of public service, they point out, particularly the light and power business, has maintained a continuous and substantial growth for more than twenty years.

The purpose of the proposed law is to widen the field of investment for savings banks by permitting them to invest part of their funds in bonds of certain public utility companies doing at least 80 per cent of their business in the United States, thus substituting a national for the present state limitation. The bill requires that these companies shall be engaged mainly in the power and light business, inasmuch as it specifies among other requirements that they must derive 75 per cent of their gross revenue from the generation and sale of electricity and not more than 10 per cent of gross revenue from street railways.

State Ownership Project in Oregon

Advocates of the Clear Lake water and power project on the McKenzie River in Oregon have watched with interest the progress of a resolution fathered by State Senator Joseph, Multnomah County, which would refer to a vote of the people an amendment to the constitution permitting the state to go into the power business. The Clear Lake project was intended primarily to deliver mountain water from this lake, which is near the source of the McKenzie River, to the towns in the low-lying Willamette Valley. Because of the cost of the project it was expected that several towns from Salem to Eugene would unite in a water district. Estimates have been made tending to show that about 50,000 hp. could be developed and delivered to these towns at a cost that is practicable, and the advocates of the project believe that if the proposed state power bill eventually becomes a law, the way will be made easy for the realization of their plans.

In his message to the Legislature Governor Pierce urged the passage of the state power resolution, saying that he believed in this as a principle. He advocated the development by the state of the Clear Lake power project and urged "that everything possible be done to encourage the construction of a plant at Umatilla Rapids [on the Columbia River] for electric and power purposes."

Four Special Trains for N. E. L. A. San Francisco Meeting

It is anticipated that at least five thousand members and guests will attend the forty-eighth convention of the National Electric Light Association, to be held in San Francisco June 15-19, and it is urged that all who contemplate attending the convention make their reservations as soon as possible. Requests for accommodations on special trains will be honored in the order of their receipt.

What is expected to be one of the most popular trains is the "Red Special," which will leave New York May 31 and stop over at various points of interest in Colorado, New Mexico, California and the Grand Canyon in Arizona. After the convention the train will return over a northern route, stopping at Portland and Canadian points and reaching New York the last of June. An extra-fast train will be the "Blue Special," a duplicate of the famous "Broadway Limited." It will leave New York June 10 and reach San Francisco four days later. The "Green Special" will leave Chicago on June 5 and embrace a nine-day sight-seeing trip through Canada and Washington and Oregon, reaching San Francisco the night of June 13. An "Orange Special," leaving Chicago June 8, will make an abridgment of the "Green Special" itinerary and consume six days en route to California. Stop-overs will be made at Seattle, Spokane and Portland. Robert B. Grove, United Electric Light & Power Company, 130 East Fifteenth Street, New York City, is Eastern traffic manager, and Godfrey H. Atkin, Electric Storage Battery Company, 613 Marquette Building, Chicago, is Western traffic manager.

While hotel accommodations in San Francisco will be ample, Carl E. Heise, chairman of the hotel committee, Room 527, Rialto Building, San Francisco, urges that reservations be made as soon as possible.

Oswego, N. Y., Will Have Barge Canal Power to Sell

The city of Oswego, N. Y., through its Water Service Commission, is canvassing the possible uses for the water power which it owns at Dam No. 6, the so-called High Dam of the Oswego branch of the New York State Barge Canal. This dam is on the Oswego River at the upper edge of the city and creates a head of about 20 ft. The drainage area of the Oswego River at this point is approximately 5,000 square miles.

After legislative and legal proceedings (see ELECTRICAL WORLD for May 10, 1924, page 977, and June 21, 1924, page 1300), title of the city to one-half of the water power at this site has been clearly established and recognized through a quitclaim deed from the State of New York. The Water Service Commission, which is in charge of the matter for the city, has as its president William J. Dowdle and includes in its membership two engineers, Charles W. Lindsley and Homan F. Hallock. The commission has been advised by former State Engineer Frank M. Williams of Albany. Recently it has in addition called in Colonel F. W. Scheidenhelm of Mead & Scheidenhelm, consulting engineers, New York City, to advise what utilization or disposition of the power should be made by the city. It is reported that the commission will welcome inquiries from prospective users of the power which is to be developed at this site.

Oswego is served by the People's Gas & Electric Company, under the management of Charles H. Tenney & Company of Boston, which has a 2,400-kva. plant and also purchases energy from the Niagara, Lockport & Ontario Power Company.

New York Committee Urges Farm Service

Some months ago a rural electric line conference committee was appointed by a group of persons interested in the distribution of central-station energy in the agricultural districts of New York State. This committee consisted of Howard W. Riley, chairman, representing the New York State College of Agriculture; Grace F. Stevenson, representing the New York State Federation of Home Bureaus; Silas L. Strivings, representing the New York State Grange; Enos Lee, representing the New York State Farm Bureau Federation, and Bert H. Shepard of the Empire State Gas and Electric Association. It has just issued an open letter addressed to M. S. Sloan, president of the Empire State association, for the consideration of the electric light and power companies in the state.

The point emphasized in this open letter is the need for co-operation between the farmers and the companies to reduce to the economic minimum the cost and upkeep of distribution lines. Excessive charges for right-of-way and property damage are condemned, and the importance of getting as many consumers as possible on every line is emphasized. Confidence in the Public Service Commission as the arbiter of rates is urged. "A limited number of acceptable forms of contract," the letter says, "can be developed to suit different typical circumstances which experience shows are sure to be somewhere encountered, and a few systems for rates can be established to meet the requirements of typical conditions that will be met with in different localities or approximately to meet the established policies of different companies. The great need is to establish clear understanding and complete confidence. The forms of contracts and of rates should be as simple and as few as possible."

Hydro-Electric Conference at Philadelphia Next Week

Under the auspices of the Engineers' Club of Philadelphia a hydro-electric conference, the third in number, will be held in the auditorium of the Manufacturers' Club of that city on Tuesday next, March 10. There will be morning and afternoon sessions, when the following papers will be presented and discussed:

"Operation of Hydro-Electric Systems and Auxiliary Steam Plants for Best Economy and Proper Governing," W. M. White, Allis-Chalmers Manufacturing Company, Milwaukee.

"Operation of Hydro-Electric Units for Maximum Kilowatt-Hours," Forest Nagler, Allis-Chalmers Manufacturing Company, Milwaukee.

"Interrelation of Operation and Design of Hydraulic Turbines," Frank H. Rogers and Lewis F. Moody, William Cramp & Sons Ship & Engine Building Company, Philadelphia.

"Operating Problems and Their Relation to the Design of Hydro-Electric Machinery in the West," Ely C. Hutchinson, Pelton Waterwheel Company, San Francisco.

"Operating Practice in Hydro-Electric Plants," Charles B. Hawley, consulting engineer, Washington, D. C.

"Features of Design in Latest Large Hydro-Electric Generators," M. C. Olson, General Electric Company, Schenectady, N. Y.

"Recent Developments in Hydro-Electric Generators," F. D. Newbury, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

In the evening there will be a dinner in the ballroom of the Bellevue-Stratford Hotel. After-dinner speakers will include Dr. William F. Durand of San Francisco, president American Society of Mechanical Engineers; Henry I. Harriman of Boston, president New England Power Company, and Charles Penrose of Philadelphia, assistant manager Day & Zimmermann, Inc.

Construction Program of Interstate Public Service

More than $2,000,000 is to be spent during the current year by the Interstate Public Service Company, Indianapolis, operating electric power, light and interurban services in Indiana, in improvements and betterments to its power production and distribution units, according to Harry Reid, president of the company. Included in this program are the installation of a 10,000-kw. steam turbine at the Edwardsport plant of the Indiana Power Company, a subsidiary organization, and the construction of a 60,000-volt outdoor substation and other equipment to make this plant a modern producing unit. This work alone, it is estimated, will entail an expense of approximately $1,000,000.

Another development is the construction of a double-circuit, steel-tower 66,000-volt transmission line from Edwardsport to Bedford to connect the Interstate and Indiana power systems. It will cost about $400,000. Another 66,000-volt line from Bedford to Bloomington will cost about $45,000, the towers already having been constructed. A third line of similar voltage is to be constructed from the Oakdale plant of the Indiana Hydro-Electric Power Company to Lafayette, a distance of 22 miles, and will cost $115,000. The two hydro-electric generating plants near Goshen, Ind., on the Tippecanoe River are to be started as soon as possible and will cost nearly $500,000.

Briefer News

Companies in Historic Virginia Territory Merged.—The Fairfax & Loudoun Light & Power Company, supplying a historic region in northern Virginia with energy generated by the Alexandria Light & Power Company, has been merged with the Alexandria company and is now being operated directly by it. Both companies are owned by the Municipal Service Company of Philadelphia, allied with Day & Zimmermann, the Fairfax & Loudoun company having been purchased by the Municipal Service Company in October last.

Floodlighting Tower of City Hall in Minneapolis.—Here is shown the tower of the City Hall in Minneapolis illuminated from a Gold Medal searchlamp on the receiving elevator of the Washburn-Crosby Company. The clock has four dials, each approximately 24 ft. in diameter. The movement which operates the hands of this clock is said to be the first one ever applied to a tower clock connected directly to the central-station service without any intervening master clock or other auxiliary apparatus in the

tower building itself. The movement consists of a synchronous motor built under the patents of the Warren Clock Company which is connected directly to the hands by the proper gearing. The tower clock and more than thirty smaller clocks in the same building are controlled by a master clock in the generating station of the Northern States Power Company.

Last Link in Iowa-Nebraska Network.—Sixteen miles of 66,000-volt transmission line about to be erected between Malvern, Iowa, and Plattsmouth, Neb., by the Iowa Service Company, connecting with the 66,000-volt line of the Nebraska Gas & Electric Company to Lincoln, will complete the "tie-in" between the Iowa and Nebraska properties of the Continental Gas & Electric Corporation.

Carrier-Current System for Puget Sound Company.—Work on the first unit of a carrier-wave system of radio communication that will ultimately connect the entire power system of the Puget Sound Power & Light Company with its offices in Seattle will be started within the next two or three weeks. The installation, the first of the kind to be undertaken in the state, will employ General Electric equipment. An antenna about 1,400 ft. in length will be strung across the Columbia River.

Another Merger in New York State.—The Central Hudson Gas & Electric Company of Poughkeepsie has asked for permission to purchase all of the capital stock of the Citizens' Railroad, Light & Power Company of Beacon, the Fishkill Electric Railway Company and the Southern Dutchess Gas & Electric Company of Beacon. It proposes to merge the street-railroad properties into the Fishkill company and the gas and electric companies into the Central Hudson company.

Richmond, Ind., to Adopt Underground Distribution System.—The business district of the city of Richmond, Ind., will soon be supplied from an underground 4,100-volt network, according to plans prepared by D. C. Hess, manager of the city's electric light and power plant. The plans call for the supply of both light and power from one four-wire network extending over an area which covers twenty-four city blocks.

New Holtwood Plant to Be Ready in July.—The first unit of the steam plant under construction by the Holtwood Power Company, a subsidiary of the Pennsylvania Water & Power Company, at Holtwood, Pa., near the Maryland border, will, it is announced, be ready for operation early in July. This plant will have an ultimate capacity of 100,000 kw. or more, the first unit being rated at 20,000 kw. The initial cost is $3,000,000. The bulk of the energy to be generated will go to Baltimore, and it is thought that when the steam plant is in operation the existing hydro-electric plant of the Pennsylvania Water & Power Company at Holtwood will no longer have to look to the Consolidated Gas, Electric Light & Power Company of Baltimore to supplement its output in seasons of low water on the Susquehanna River.

Washington Court House Plant Changes Hands.—Sale of the Washington Gas & Electric Company of Washington Court House, Ohio, by the North American Light & Power Company to the Dayton (Ohio) Power &

Light Company took place a week or two ago, the transaction involving, it is said, approximately $500,000. The plant furnishes electricity to New Holland, Leesburg and a number of other communities in the vicinity, as well as to Washington Court House. It will be equipped to serve as an auxiliary power plant for the Dayton company, which, as announced last week, has itself just become part of the Columbia Gas & Electric Company's system.

Frenchman Generates Direct Current of 500,000 Volts.—A generator capable of producing a continuous current of 500,000 volts was demonstrated this week at the Academy of Science in Paris by Professor d'Arsonval, according to a New York *Times* cable dispatch. The apparatus was presented to Prof. Jean Perrin for use in researches into the constitution of matter and will also, it is said, be used in research work on the cure of cancer. Professor d'Arsonval expressed the opinion that a generator of the same pattern could be constructed which would give much higher voltage.

Des Moines Company Seeks Right to Dam River.—A bill authorizing the Iowa Power & Light Company to construct a dam across the Des Moines River has been introduced in Congress. The site of the proposed dam is just below the Balls Ford power plant of the company at Des Moines, now under construction. Manager M. G. Linn of the Des Moines Electric Light Company, of which the Iowa Power & Light is a subsidiary, says that the dam will be of the collapsible type and that its primary purpose is to insure a supply of condensing water. It will keep the river at normal level during low water and will be dropped during high water.

Student Branch Convention of the A. I. E. E.—Next Monday, March 9, nine educational institutions in the Philadelphia district will hold an A. I. E. E. student branch convention at the Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia. These institutions are Princeton, Lehigh, Lafayette, Swarthmore, Villa Nova, Pennsylvania, Haverford, Drexel and Delaware. In the morning there will be technical papers written by students, in the afternoon technical inspection trips and in the evening a dinner at the university which will be addressed by Farley Osgood, president of the Institute. A students' vaudeville entertainment will be the final feature.

British Paper Says Government May Issue £50,000,000 in "Electricity Bonds."—A plan to stimulate British industry by the production of much cheaper electricity is being considered by the British government, according to the London *Daily Mail*, which may take the form of an issue of "electricity bonds," guaranteed by the government, to an ultimate value of £50,000,000. The paper asserts the scheme apparently is meant to offset the one favored by the Labor party and based on the principle of nationalization of the means of production. It aims to bring electricity within the reach of every industry and every private individual at a cost of from 2 to 3 cents a kilowatt-hour, as compared with the present average cost of 10 cents. There are now more than five hundred power stations supplying certain areas, and, according to the newspaper, experts have figured that the entire country could be cared for at a fraction of the present cost by one hundred stations properly situated.

Rochester Company's Proposed Mount Morris Dam.—Assistant General Manager C. L. Cadle of the Rochester (N. Y.) Gas & Electric Company recently gave some details concerning the hydro-electric plant which the company contemplates building at Mount Morris on the Genesee River. "The capacity of the dam," he said, "will equal that of the Roosevelt Dam. The top will measure one-quarter mile across. Water could be drained out in February or March, leaving it in condition to catch the spring freshets, and it would be a protective asset to the community in flood time. More than 120,000 tons of coal each year will be saved by the use of the power from this dam instead of steam power now in use. During the rush hours for about eight hours daily 60,000 hp. would be generated. The power will be brought to Lincoln Park over 60,000-volt lines and reduced to 11,000 volts for transmission to the city. As Rochester is not at present of sufficient size to absorb the immense amount of power which would be developed, it will be necessary to make agreement with out-of-town concerns to buy their power until Rochester needs it in the future. When these agreements are completed, the work will go ahead."

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, Oklahoma City.

Illinois State Electric Association—Hotel Sherman, Chicago, March 18-19. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

American Institute of Electrical Engineers—St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association, Hot Springs, Ark., April 21-24. R. I. Brown, Arkansas Central Power Co., Hot Springs, Ark.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

American Institute of Electrical Engineers — Regional conventions, Swampscott, Mass., May 7-9; Cleveland, May 22-23.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section.) H. M. Davis, Fraternity Building, Lincoln, Neb.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Iowa Section, N. E. L. A.—Waterloo, Iowa, June 3-4. H. E. Weeks, 623 Union-Davenport Bldg., Davenport.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Colorado Power Rates Down Again.—Announcement is made that the rates of the Colorado Power Company, which was taken over last year by the Public Service Company of Colorado, have been reduced in response to the long-continued protest of the Colorado Metal Mining Association that the rates were too high to permit profitable operation of the mines. It will be remembered that an increase in the valuation of the Colorado Power Company's property of more than 100 per cent was granted by the United States District Court at Denver a year ago after a four-year fight. A 20 per cent raise in special-contract rates followed. Then came the transfer of control to the Public Service Company, which on February 1 last reduced the new rate by from 7 to 10 per cent.

Closing Long Transmission Loops in Iowa.—The Iowa Service Company has completed construction of a 33,000-volt transmission line from Marne to Lewis, which closes a complete circuit of 100 miles, linking up towns to the north of Red Oak. The circuit involves Malvern, Avoca, Marne and Elliott, with Red Oak as its principal turning point. The recent completion of a transmission line between Clarinda and Villisca closed a 125-mile loop to the south touching Red Oak, Malvern, Shenandoah, Clarinda and Villisca. A 66,000-volt transmission line will soon be constructed from Plattsmouth to Malvern connecting up the recently completed line of 66,000 volts from Lincoln to Plattsmouth.

Yampa River Good for 120,000 Continuous Horsepower.—Topographic maps of the course of the Yampa River in Colorado and the Green River in Utah, Colorado and Wyoming, prepared for use in studying the best means of utilizing their resources, have been published recently by the Department of the Interior through the Geological Survey and are for sale by it for 10 cents a sheet. A manuscript report shows that 120,000 continuous horsepower can be developed at five sites on the Yampa River. This report, which describes fully the prospects for water power and storage, may be consulted at the offices of the Geological Survey at Washington and Salt Lake City. A similar report on the power possibilities of Green River from Green River, Utah, to Green River, Wyo., is in preparation.

Men of the Industry

A. G. Wishon Heads San Joaquin Utility

A. G. Wishon, vice-president and managing director of the San Joaquin Light & Power Corporation, who, as already reported in the ELECTRICAL WORLD, was named president of that company at a recent meeting of the board of directors in succession to William G. Kerckhoff, is a pioneer in the central-station field in California. Mr. Wishon became interested in the development of water powers in the central part of that state as early as 1895. Upon the abandonment of his first venture the necessary capital was obtained

A. G. WISHON

to finance the Mount Whitney Power Company, and its first plant was placed in operation in 1899. Mr. Wishon remained as general manager of this company until 1902, when he became interested in a new project on the Tule River.

In promoting this project he interested Mr. Kerckhoff, A. C. Balch and other capitalists, and the business has grown by constant development into the present San Joaquin Light & Power Corporation, now controlled by the Western Power Corporation of New York. Mr. Wishon served as general manager of this company until 1920, when he became vice-president and managing director.

Gerard Swope, president of the General Electric Company, returned to New York aboard the *Conte Verde* on February 28 after a pleasure trip of several weeks through southern Europe.

Thomas E. Murray, president of Thomas E. Murray & Company, Inc., and vice-president of the New York Edison Company, has been elected a director of the Brooklyn Edison Company to succeed the late Herbert L. Bridgman.

Frederick D. Knight has been appointed assistant superintendent of the generating department of the Edison Electric Illuminating Company of Boston. Mr. Knight has been in the construction division of Stone & Webster, Inc., Boston, for the past seventeen years, and was superintendent of construction for that organization in the enlargement of the Watertown Arsenal during the war. More recently he was in charge of construction at the South Meadow station of the Hartford (Conn.) Electric Light Company and at the Weymouth station of the Boston Edison company. He has been actively identified with much important steam-plant building by the Stone & Webster organization.

William H. Bassett, technical superintendent and metallurgist of the American Brass Company, Waterbury, Conn., has been awarded the James Douglas medal for distinguished scientific achievement in the brass industry. The award was made through the American Institute of Mining and Metallurgical Engineers.

O. G. Thurlow Elected Vice-President

O. G. Thurlow, a veteran member of the Alabama Power Company organization, was recently elected vice-president in charge of engineering at a meeting of the board of directors. He has been prominently identified with all construction and engineering work performed by the Alabama company since 1912, the date which marks the beginnings of its development work in Alabama. The famous Wilson Dam at Muscle Shoals was among the projects designed by Mr. Thurlow, who served as consulting engineer for the United States government on this job.

A native of Newburyport, Mass., and a graduate of the Massachusetts Institute of Technology, Mr. Thurlow received his first practical experience with George F. Swain, consulting engineer, engaging in the design and construction of the East Chicopee Bridge crossing the Connecticut River. Following similar work in Pennsylvania and New York and subsequently in Porto Rico, he joined the Alabama Power Company, where as designing engineer and more recently as chief engineer he has contributed constantly to the progress of the organization. Mr. Thurlow is a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers and the Engineers' Club of New York.

R. H. Tapscott Receives Promotion

Ralph H. Tapscott, for the past six years assistant chief electrical engineer of the New York Edison Company, has been appointed electrical engineer. After graduation from Union College Mr. Tapscott was for seven years an engineer in the lighting engineering department of the General Electric Company at Schenectady, following one year in the testing department.

R. H. TAPSCOTT

Mr. Tapscott is active in both the National Electric Light Association and the American Institute of Electrical Engineers, having served on many committees in both societies. He is past-chairman of the electrical apparatus committee of the former and is secretary of the New York Section of the latter.

Obituary

Henry C. Freeman of the H. C. Freeman Company, Boston, representative of the Jeffrey Manufacturing Company, manufacturer of material-handling equipment, Columbus, Ohio, died recently at Boston.

George W. Bixler, advertising manager of the Public Service Company of Colorado, died in his fifty-third year, February 20, after an operation for gallstones. Mr. Bixler was born at Eldorado, Ill., and had been with the Public Service Company since 1905.

Colonel Robert C. Clowry, formerly president and general manager of the Western Union Telegraph Company, died February 26 on a train bringing him from Palm Beach to New York. Colonel Clowry was a pioneer telegrapher, his career in this field covering a period of fifty years and embracing positions ranging from messenger boy in 1852 to president of the largest telegraph company in the world in 1922. He was eighty-seven years of age.

E. H. Raymond, vice-president of the Crane Company, Chicago, who had been on a business trip of about ten days through the South, was found dead in his berth on a Texas & Pacific train at New Orleans on February 24, apparently a victim of heart trouble.

George P. Barton, general patent counsel for the Western Electric Company for twenty-eight years, died March 1 in the Ossining Hospital, Ossining, N. Y. A native of Lorraine, N. Y., and a graduate of the University of Rochester, Mr. Barton took up law in Chicago when his brother, Enos, was just starting the Western Electric Company. Undertaking the patent work of the company, he took part in the litigations resulting from the development of telephone engineering. Mr. Barton retired from active business in 1912.

Commission Rulings

Conditions Governing Abandonment of Service.—Asserting that a public utility company cannot be compelled against its will to continue to render public service which can be furnished only at a loss, the New Hampshire Public Service Commission granted authority to the Van Auken electric plant in West Campton, a small concern serving neighbors, to abandon operation on condition that the owner should offer the property for sale to any one who might wish to purchase it for the purpose of continuing its operation as a public utility at a price not exceeding that which could be obtained for it if disposed of otherwise.

Disposition of Excess Purchase Price in Merger of Small Plants with Larger One.—In approving an application for the merger of four small electric light and power companies with the Atlantic City Electric Company, the New Jersey Board of Public Utility Commissioners made the stipulation that the difference between the value of the small plants as found by the board and the value as found by the engineers of the utility companies should be transferred from profit-and-loss surplus account to accrued-amortization-of-capital account unless part of the liabilities were canceled and the value of the common stock accordingly increased.

Fees Paid in Acquisition of Property Are Not to Be Capitalized. — The Missouri Public Service Commission in denying an application of the Arkansas-Missouri Power Company for authority to acquire certain property and issue securities in connection therewith made these among other rulings: A fee charged by a former president of the company for negotiating the sale must be disallowed as part of the value for which securities may be issued. The cost of attorneys' services in transferring the property should not be capitalized but should be considered as an expense rendered in connection with the issuance of securities, in the same category as bond discount, and subject to amortization out of income available for return, surplus and contingencies. The cost of additional materials and supplies is a proper charge to capital account.

Apportioning the Expense Caused by Unprecedented Water Shortage.—In authorizing the Nevada-California Power Company to charge increased rates because of extraordinary and unforeseen operating expenses forced upon it by the unprecedented drought of 1924, the Nevada Public Service Commission made these observations: "After a consideration of all facts we are of the opinion that the extraordinary operating expenses caused by the necessity to purchase steam standby power should not be borne entirely by the applicant, and, on the other hand, all this expense should not be borne by the consumers. The mining and industrial consumers of the applicant enjoy relatively low rates when compared with the domestic lighting and cooking consumers. The mining consumers have made large profits in the past and will undoubtedly continue to do so. The applicant has made fair earnings in the past and will probably continue to do so for some time in the future. We are of the opinion that increase in rates, where necessary, should, so far as equitable, be borne by the consumers who use the utility for profit, and not by the small domestic consumers." The commission granted a 20 per cent increase in rates for all except lighting and cooking consumers, this increase to be revoked as soon as the extraordinary expense which the company was undergoing should cease.

Recent Court Decisions

Contract Void for Lack of Mutuality in Clause Affecting Maximum Rates.—The United States Circuit Court of Appeals in Nebraska has found, in Nebraska Gas & Electric Company vs. City of Stromsburg, that a state law empowering a city of the second class to make an irrevocable contract with a public utility company fixing maximum rates for twenty years was not in violation of an article in the state constitution forbidding the Legislature to make "any irrevocable grant of special privileges." Equity, said the court, will not give relief from confiscatory rates fixed by a valid contract in such a case, and validity must be construed by the same rules as with any other contract. Decision of the lower court in favor of the defendant, which sought to prevent the company from refusing to conform to the rates so fixed, was, however, reversed on the ground that the contract was void for lack of mutuality inasmuch as it gave the city the right at four specified times during its existence to move for a rate revision, the company thus being bound for twenty years as to maximum rates and the city for a much shorter period. (2 (2d) Fed. 518.)*

Two Proposed Municipal Undertakings Cannot Be Submitted to Voters as One.—The Washington State Supreme Court, as already reported in the news columns of the ELECTRICAL WORLD, invalidated a municipal election held in Aberdeen, in that state, which had sanctioned a bond issue to extend the city waterworks and also build a municipal power plant. In declaring the election illegal because the two projects were combined the court said (Dole vs. City of Aberdeen): "Manifestly, the business, and it may well be called such in view of the proprietary capacity in which the city acts with reference thereto, of furnishing water to itself and its inhabitants and the business of the city furnishing electric light and electric power to itself and its inhabitants are different businesses. Each looks to the rendering of a different unrelated service by the exercise of a different unrelated grant of power. The mere fact that the construction and operation of two such plants might be efficiently economized by constructing and operating them so that both might in some measure be aided from one source does not change the situation in so far as we are concerned with the right of the elector to vote separately on the questions of whether or not the city shall extend its waterworks and acquire a power plant. The decisions of the courts do not seem to be in harmony upon the question of what are related projects capable of being lawfully submitted to the electors as a single proposition. We are convinced, however, that we are committed to the view that the uniting of projects such as we have here under consideration and the submission of them to the electors for ratification or rejection as a single proposition is unlawful." (230 Pac. 401.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Texas Court Upholds Right of City to Construct Electric Plant Regardless of Existing Utility.—In January, 1923, the property taxpaying voters of the city of Vernon, Tex., at an election held for that purpose, voted for the issuance of $100,000 of municipal bonds for the erection and construction of an electric light plant for the city. A taxpayer filed suit against the Mayor and other officials to restrain them from issuing and selling the bonds, alleging that the election was null and void under the city charter, since under its charter it was provided that whenever the city should operate and maintain an electric lighting system the right to operate such utility should be exclusive, and since the erection and operation by the city of such a utility would conflict with the franchise of the existing utility. The Court of Civil Appeals of Texas (Montgomery vs. City of Mount Vernon) reversed the judgment of the trial court granting a perpetual injunction and rendered judgment for the city.

Jury Must Decide Applicability of Doctrine of Res Ipsa Loquitur.—Damages awarded for the death of an electrical worker (Jackson vs. Arkansas Light & Power Company) who fell over unconscious after turning a switch at a transformer substation and died in an hour without regaining consciousness were sustained by the Supreme Court of Arkansas. The company claimed that the apparatus operated by the decedent was in good order and that the cause of his death was a matter for speculation. The court, while maintaining that the doctrine of *res ipsa loquitur* ("the thing speaks for itself") does not relieve the plaintiff from the obligation to prove negligence, nevertheless held that the jury had the right to apply the doctrine, there being no evidence that the victim was injured by his own negligent or improper manipulation of the lever which he pulled. The theory had been advanced that the man was killed by striking his head against a timber lying on the ground, but the question, the court said, was what caused him to fall. (267 S. W. 352.)

Manufacturing and Markets

Fixture Makers Oppose Unionizing Shops

Situation in Cleveland and Chicago the Result of Support of Contractors for Selfish Reasons

ALL the fixture manufacturers in the New York district, numbering about seventy-five, recently met at the rooms of the Electrical Board of Trade of New York, Grand Central Terminal Building, New York, at the request of Charles L. Eidlitz, chairman, who explained the situation now existing in Cleveland and St. Louis that affects the fixture-manufacturing industry. In these cities the Electrical Workers' Union has taken the stand that lighting fixtures will not be installed by their members unless they are wired by union labor. In Chicago also there has existed a rule that the union will not install panelboards or switchboards that are not made in Chicago under certain Chicago union conditions. Mr. Eidlitz believes that such a scheme is a menace to the growth of the electrical industry and that if it can be applied to switchboards and fixtures, it can also be extended to cover a multitude of other apparatus and appliances.

New York Union Flirts with Idea

Mr. Eidlitz says that he has reason to believe that in certain locations influential contractors are giving their support to this idea for purely selfish reasons and this is the source of the trouble. Neither the New York electrical contractors nor the New York electrical union have ever lent themselves in any way to this proposition, though Mr. Eidlitz says that at present the tendency of the New York union is to flirt with the Cleveland and Chicago idea. At the meeting of the New York fixture manufacturers a resolution was passed that they would not permit the unionizing of their works and that such a move would be opposed. The board of governors of the Electrical Board of Trade of New York also later passed a resolution to the effect that it was not willing to have a change made in the labor conditions as they exist in the electrical industry today.

State Licensing Proposed in Illinois

THERE is now before the State Senate of Illinois a bill providing for the licensing of master electricians. The National Electrical Code would then serve as a uniform basis for inspection practice in the state. The licenses would be granted to supervisors of electric works who have had four years' practical experience and have passed an examination on qualifications. Three grades of certificates would be issued, based on the population of the municipality concerned. The Electrical Contractors' Association feels that uniform licensing would reduce the expense of manufacturers in endeavoring to meet the great variety of inspection requirements and would provide for the smaller communities the same adequate protection and quality of installation that is available in the larger communities. A similar licensing law is now up for consideration in Wisconsin.

Must Dog Eat Dog in Electrical Business?

Present Practice of One Manufacturer Preying on the Other Manufacturers' Jobbers Is Economically Wrong—Not Impossible to Work Improvement

By a Prominent Jobber

WILL it ever be possible to bring about an understanding between manufacturers as a class and jobbers as a class whereby there will be a more rigid recognition of trade channels? Our personal relations with our individual suppliers are, in the main, satisfactory, but why, for example, should the Smith Wire Company crucify me because I happen to buy my wire from the Jones Wire Company? And why should the Jones Wire Company, by the same token, crucify my competitor because he buys from Smith? Has a jobber any rights which a manufacturer is bound to respect? If Smith and Jones adopted a policy of selling to jobbers only, wouldn't Smith and Smith's jobbers and Jones and his jobbers all be better off? Is it right for a manufacturer to train his guns on every jobber who is not his own customer? Why can't there be peace in the industry and a let-up on manufacturer competition? Does the law positively forbid such a peace?

These questions are not easily answered. If they are answered satisfactorily, it means a revision in electrical trade practices from the foundation up—a revision which would require the experience and judgment of a great many men representing all branches of the industry. Unfortunately, the manufacturers have kept aloof from the jobbers and dealers on questions of this kind, but it requires no great amount of imagination to visualize a conference at which all branches might be represented.

If I were offering my opinions to such a conference, I should say first that we ought to agree upon the principle that trade naturally flows from the manufacturer to the jobber, thence to the dealer, and ultimately through him to the consumer. This postulate would have to be subject to a great many exceptions, and I think it is with the exceptions that the conference would have chiefly to deal.

Jobbers' Function to Warehouse

I believe it should be recognized that the fundamental job of the jobber is that of warehouseman and that material which cannot be easily warehoused should be excluded from the general scheme. The more liberal the manufacturer's attitude toward the jobber, the greater warehouse stock the jobber could carry, so that eventually the postulate might go through completely without exception. For instance, few, if any, jobbers warehouse poles, but if a situation could be developed whereby poles could be handled profitably by jobbers, no doubt the majority of jobbers would stock them. At the outset, however, poles would doubtless form a characteristic exception.

Having decided upon these prerequisites, it could then be declared fashionable that manufacturers should keep clear of all lines which were not specifically excepted and that the jobber's function with regard to material not specifically excepted should be respected, regardless of what manufacturer's material was sold. This, I realize, is an ideal condition, but it is not now even remotely approximated. It might be gradually brought within seeing distance if those of us who are interested, and particularly the trade papers, would endeavor to build up a sentiment in the industry that manufacturers should be a little more regardful of distributors, whether their own distributors or those of some other manufacturer, on the basis that by the law of reciprocity each manufacturer would gradually learn to protect the other manufacturer's distributors in consideration of having his own distributors receive like treatment.

Jobber Cannot Sell to Large Buyer

While this looks like a pretty large contract, the situation is so bad that even a little effort could work a large amount of improvement. For instance, it is virtually impossible for a jobber to sell a large central-station company a carload of wire. This business almost invariably goes to manufacturers. Pole-line hardware, which most jobbers stock, can only be sold by the jobbers in very small quantities, because when it runs into large money manufacturers begin to compete with each other as well as with the jobber, and some manufacturer takes it at the jobber's cost or less. If a hotel is in the market for a couple of hundred electric fans, the sale is almost invariably made by some manufacturer. Even such pitiful items

as sockets can be bought by a small fixture dealer from some manufacturer or other at the jobber's cost so keen is he to obtain the order regardless of the result.

The reason for this is largely competition among manufacturers themselves. Another important reason, however, is the feeling on the part of many manufacturers that if they have not a jobber in some particular town, they are under no obligations to respect the jobbers in that town. Many manufacturers are positively unhappy unless they have representation in every town in the country. In small towns where there are only two or three jobbers it is obviously impossible for every manufacturer to have representation. In such cases the manufacturers who are not represented should seek to obtain their volume elsewhere. For if every manufacturer insists upon having business in every town, the cost of procuring the business will be prohibitive and the ultimate volume accruing to any individual manufacturer will be negligible and unprofitable when divided between them all.

I realize that the condition which I am outlining as desirable is largely ideal. But it is an ideal worth striving for, and its achievement would not be more extraordinary than many other things which, at first apparently impossible, have yet come to pass.

Value of Uniform Wiring Regulations

Universal Standard Will Eliminate Excess Costs and Benefit Entire Industry—National Code Called Safety's Factor of Safety—Co-operative Development

THE economic value of uniform rules covering the installation of electric wiring and materials was considered as a subject of especial interest to all branches of the electrical industry at the recent meeting of the Eastern Association of Electrical Inspectors. J. H. Trumbull, Governor of Connecticut and president of the Trumbull Electric Manufacturing Company, spoke on the necessity and urgent need for a uniform electrical ordinance to make possible a universal interpretation of the National Electrical Code. This address of Governor Trumbull was published in the February 28 issue of the ELECTRICAL WORLD.

C. A. Bates, electrical engineer Bryant Electric Company, also gave his views concerning a uniform wiring code and stated that it would eliminate excess costs and benefit the entire industry. Mr. Bates pointed out that this question was also of very great interest to the consumer, who, although not a member of the electrical industry, has a primary right to be considered in the making of rules and in the application or interpretation of them. This right was said to be based upon the fact that in the final analysis he pays the bills.

MANUFACTURER HAMPERED BY RULES

"The manufacturer of wiring materials wishes to sell his goods at a price that will not hamper the increased use of electricity," said Mr. Bates, "and to fulfill that wish he must carefully study the different factors having a bearing on the manufacture and sale of electrical material. Rather early in this list of factors he finds the matter of rules covering the installation of his goods. If he does business in only one city, his problem is a simple one, but if he does an interstate or nation-wide business, he is confronted with rules which differ in the different cities or states.

"Differing rules cause the manufacturer to produce goods that are different. Sometimes the differences are great and sometimes they are small, but in either event they prevent quantity production, and we all know that goods can be manufactured in large quantities more cheaply than in small.

"In addition to the interference with quantity production, we must add other items which also increase the cost of producing goods. Very often the raw materials must be different, and this increases the purchasing problems. Warehousing of raw materials and finished goods is multiplied and complicated. Care must be taken that the right goods are shipped to the right territory, and this applies not only to the manufacturer but to the jobber as well. It adds to the costs of both the manufacturer and the jobber to exercise this care.

"I will not attempt to enumerate the many ways in which costs are increased because of differing rules, but would like to point out that, in addition to the manufacturer and the jobber, the public utility and the contractor are also subjected to increased costs. There are various reasons why we have different rules in different states and cities, but I believe we are all commencing to realize that these reasons are not so compelling as we once thought they were.

UNIVERSAL STANDARD ESSENTIAL

"The uniform ordinance will make easier the problem of keeping ordinances up to date and in harmony with the National Electrical Code as it is revised. The interchange of information and experience between the different branches of the industry and the different members of the same branch is leading to the belief that special rules are not so necessary after all. If the different localities harmonize their rules with the National Electrical Code and if the interchange of information leads to a uniform interpretation of those rules, we shall then have a universal standard."

A. R. Small, vice-president of the Underwriters' Laboratories, Inc., and chairman of the electrical committee of the National Fire Protection Association, said in addressing the inspectors' association that the present "squirrel-cage" process of manufacturing laws has a direct bearing upon local orders and other regulations governing methods of equipping premises for the utilization of electricity, and a householder, be he taxpayer or tenant or even passer-by, instinctively reacts to a fire or injury from electrical causes with the demand for additional legislation.

"Electrical inspectors realize that a fair percentage of those who demand laws for this and that purpose are indifferent to their non-compliance until some injury is done," said Mr. Small. "Bridging of fuses, unrestricted wiring with cords and bell wire proceed merrily with no challenge to the moral or social conscience of the lawbreaker or his friends until harm to something or some one results. Experience shows that the public does not demand punishment for such infractions of the law, even when injury results, unless it also is shown that a mercenary or similar vile attempt was the motive for such breaking. 'It was unfortunate,' is the usual attitude when such a motive is absent. Juries have recorded this phase of mass psychology too often for one to doubt its existence or extent.

CONFLICTING RULES ANNOY PUBLIC

"The normal indifference of the public to the literal text of a law changes to violent opposition when, as is too often the case, the law's demands differ for similar details. We all protest silently or actively against differences in rules of the road. To each of us 20 miles an hour is as safe a speed in one county as in another. We have become a nomad people in a sense. For similar situations we have similar reactions. Green lights to 'stop' in one town and to 'go' in the next are confusing and in the last analysis reduce safety's factor of safety and destroy the very reason for their existence.

"The laws of fire, of electricity, of mechanics and chemistry are immutable—otherwise chaos results which repels all progress in understanding or accomplishment. Similarly, rules for electricity's use generate opposition and disrespect unless founded on the fundamentals of forces and properties of materials—therefore, the status of our National Electrical Code. It answers the demand, instinctive or sensible, for uniformity where like situations arise.

NEW PROGRAM WILL STRENGTHEN CODE

"The recent reorganization of the program for revising the National Electrical Code and the tying in of the new program with the American Engineering Standards Committee movement accomplishes participation therein of all interests affected by its provisions. It insures deliberate consideration of every change or addition. No one interest has or can exert a predominant influence.

A fair balance is secured both in interest and in geography. It is the expectation that the program will secure for the code such a technical and professional, if not legal, status as to make it more than ever the 'Bible' of electrical work in the home, in commerce, in industrial establishments and in all places of public assembly. More than ever will the burden of proof be upon him who defies or ignores it. It surely provides safety's factor of safety in matters electrical."

Business Conditions

ELECTRICAL manufacturers report receiving more inquiries from central-station companies for power-house equipment, switching apparatus and power transformers. Orders from this source are, therefore, expected to reach a very good volume during this month. A large manufacturer reports that sales of generating equipment to industrial customers have been larger during February than in any month since 1918. The demand for motors and general supply lines is in fair volume and consists of many small orders.

A wire company states that inquiries have been received during the last week for approximately 10,000,000 lb. of copper wire, and another manufacturer is now filling an order for a central-station company covering $18,000 worth of switchboard instruments. The outlook for export trade is decidedly better. Orders for generators, motors, transformers, radio, etc., are said by a large manufacturer to be much better for the first six weeks of this year than for the same period in 1924.

Pig-iron production during February was at an annual rate of over 42,200,000 tons—3½ per cent better than the same period last year—and compares with 40,361,000 tons, the record output in 1923. The American Brass Company announced a reduction last week Friday of ¼ cent per pound on its prices of sheet copper, brass tubing and bars.

In New England a good volume of small orders is being received, but a slackening in sales is reported by manufacturers and jobbers. Motor and general supply sales in the New York district are well distributed but in small volume. Central-station companies are issuing many inquiries for power-house equipment, and jobbers' sales are reported as quiet in that territory. In the Southeast central-station expansion and improvements, especially in Florida, are calling for large quantities of line-construction material. Several satisfactory sales of electric trucks have been reported in that district. The volume of business in the Middle West compares favorably with last year, and sales in February are reported as satisfactory. On the Pacific Coast much postponed construction work has been resumed and is resulting in perceptibly better sales.

Potential Electrical Market in China of Great Value

THE electrical industry in China has been exceptionally good until about two years ago, when the political factions started the trouble which still continues in a good part of the country. As soon as the present trouble is settled and a stable government is established, there is expected to be a wonderful improvement in business throughout China. American manufacturers can obtain their share of this Asiatic trade, which is valuable, by making preparations and establishing themselves in this foreign market at this period.

Many of the cotton, rice, oil and other mills and manufacturing plants are electrically driven, by either unit or group drive. The central province has gone into cotton spinning extensively, the cotton mills ranging from 5,000 to 100,000 spindles. The buildings are of the latest type, strictly fireproof. Electrical and cotton machinery is in most cases imported either from America or Europe, but Europe is at present getting the bulk of this trade. There is practically no manufacturing of electrical goods in China.

Metal Market Somewhat Stronger —Sales Increase

SINCE Monday the metal market has been somewhat stronger, and sales have been more active, especially in lead, zinc and tin. Metal producers would not be at all surprised to see a more active market generally in the next month or two, and the course of prices in the next few days will be watched more critically than usual as an indication of what may be expected during the spring months.

Copper lost ground in an inactive market until Monday, a few orders being booked at 14⅛ cents delivered. Most of the larger producers are continuing to quote either 14⅜ cents or 14½ cents without expecting to get much business. With the stronger tone of the foreign market on Tuesday morning, offers of 14⅛ cents were all withdrawn. On Tuesday and Wednesday the lowest sellers were asking 14⅜ cents. A fair tonnage was sold at that level, but some sellers found it necessary to make concessions of a few

NEW YORK METAL MARKET PRICES

	Feb. 25, 1925 Cents per Pound	March 4, 1925 Cents per Pound
Copper, electrolytic	14⅛–14⅜	14.6
Lead, Am. S. & R. price	9¼	9
Antimony	20	17½
Nickel, ingot	31	31
Zinc, spot	7.85–7.90	7½
Tin, Straits	57	55.30
Aluminum, 98 to 99 per cent	28	28

Value of Electrical Exports for January, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

	January 1924	January 1925
Generators:		
Direct-current:		
Under 500 kw.	$81,508	$70,169
500 kw. and over	75,174	4,340
Alternating-current:		
Under 2,000 kva.	20,231	14,451
2,000 kva. and over	144,647	230,953
Steam turbine-generator sets	1,900	30,814
Accessories and parts for generators	102,328	107,466
Self-contained lighting outfits	69,261	119,596
Batteries:		
Flashlight	64,299	84,374
Other primary	48,153	79,607
Storage	216,223	204,434
Transforming or converting apparatus:		
Power transformers	541,101	253,407
Other transformers	317,824	125,010
Rectifiers, double-current and motor-generators, dynamotors, synchronous, and other converters	141,032	144,479
Transmission and distribution apparatus:		
Switchboard panels, except telephone	188,863	143,079
Switches and current breakers over 10 amp.	256,555	249,088
Fuses and fuse blocks	29,117	30,625
Watt-hour and other measuring meters	160,569	38,578
Volt, watt and ampere meters and other recording, indicating and testing apparatus	113,986	162,539
Lightning arresters, choke coils reactors and other protective devices	105,616	78,586
Motors, starters and controllers:		
Motors under 1 hp	147,857	140,713
Stationary motors:		
1 to 200 hp.	318,836	134,244
Over 200 hp.	46,860	18,747
Railway motors	260,165	51,466
Electric locomotives:		
Railway	35,550	118,509
Mining and industrial	32,957	21,260
Starting and controlling equipment for:		
Industrial motors	254,725	62,213
Electric railway and vehicle motors	36,141	6,134
Accessories and parts for motors	115,603	165,449
Electric fans	140,673	92,434
Electric lamps:		
Metal-filament	102,466	111,184
Other electric lamps	35,384	26,085
Flashlights	54,095	99,108
Searchlights and projectors	42,607	41,852
Motor-driven household devices	$68,185	$112,464
Domestic heating and cooking devices	82,108	91,595
Industrial electric furnaces and ovens	29,383	29,130
Therapeutic apparatus, X-ray machines, galvanic and faradic batters, etc	79,726	111,494
Signal and communication devices:		
Radio apparatus	331,849	784,619
Telegraph apparatus	38,513	138,529
Telephone apparatus:		
Magneto telephones	6,088	12,448
Other telephones	71,141	26,045
Telephone switchboards	83,417	7,580
Other telephone equipment	154,583	218,410
Railway signals, switches and attachments	46,638	127,343
Bells, buzzers, annunciators and alarms	8,795	12,361
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	145,964	200,267
Insulating material	167,070	149,455
Metal conduit, outlet and switchboxes	34,910	45,606
Sockets, receptacles and lighting switches	123,091	112,461
Electric lighting fixtures, interior and street	43,980	81,683
Other wiring supplies and line material	141,686	68,577
Other electrical apparatus not elsewhere specified	713,836	732,117
Globes and shades for lighting fixtures	38,677	38,369
Electrical glassware, except for lighting	17,154	19,120
Electrical porcelain	195,141	†
For less than 6,000 volts	*	130,773
For 6,600 volts and over	*	703
Electrical carbons, carbon brushes, electrodes	259,811	†
Electrodes for electric furnaces	*	51,656
Other carbon products	*	200,152
Insulated wire and cable (iron and steel)	63,568	26,420
Other manufactures of aluminum	68,944	65,215
Copper, bare wire	116,897	305,071
Copper, insulated wire and cable	218,925	332,825
Total electrical machinery and apparatus and supplies	$7,652,349	$7,493,501

* Not separately stated prior to Jan. 1, 1924.
† Discontinued beginning Jan. 1, 1924.

points. Several large orders were rumored as being placed by electrical manufacturers during the week, but as far as can be ascertained many of them never got beyond the inquiry stage up to Wednesday. A good tonnage seems to be wanted, but the bids were too low to attract sellers.

On Tuesday the American Smelting & Refining Company reduced its contract price for lead from 9¼ cents to 9 cents. This reduction was expected by the trade as 9 cents was all that most other producers could obtain for more than a week. The market is now somewhat firmer. Sales have decreased, but the earlier business of the week absorbed all loose lots. Consumers have only sufficient lead for current requirements. The marked decline in zinc on Monday attracted a lot of buying by galvanizers, who have been largely out of the market for some weeks. A pronounced cut in the price of tin also attracted a large volume of buying by consumers, who have been quick to take advantage of all price reactions recently.

Business in Middle West Compares Well with Last Year

ELECTRICAL trade in the Middle Western territory is reported as having been satisfactory during February in most cases. In some lines business appeared spotty, but generally the volume transacted compares favorably with last month and a year ago. Every indication appears to point to better business during March. The railroads have purchased much equipment and the utilities are expected to be in the market soon for various construction items and apparatus. Among orders placed was one for a set of storage batteries approximating $250,000. Numerous smaller orders for induction feeder-voltage regulators, subway transformers, meters, etc., were also placed. The demand for motors and high-tension equipment has been good.

Jobbers have had a rather good week. While there have been no remarkable orders received, a consistent demand for many commodities has kept most jobbers normally busy. Numerous building programs are being outlined at this time, and the building permits issued during February exceeded those of last year by several million dollars. Radio sales fell off considerably during February, and collections have improved materially.

Good Volume of Small Orders in the New England District

THOUGH the volume of small orders throughout the New England district continues to be encouraging, a moderate slackening in sales is admitted by many manufacturers and jobbers. Many inquiries and negotiations are reported and a feeling of optimism prevails. A very active interest is reported in electric construction products, with small orders the rule at present.

A prominent manufacturer reports the sale of three carloads of cross-arms and a fair movement in poles and line wire. A well-known electric furnace manufacturer records the sale of one 20-kva. and two 15-kva. furnaces to the Pratt & Whitney Company, of Hartford, Conn., and predicts increasing activity in the tool-making industry. Electric ranges for domestic use shows a 20 per cent increase for 1925 to date for one company as compared with the corresponding period in 1924, and a record in sales for a single day to date is reported by a distributor of electric power-driven tools of the universal type, which appear to be in good demand among contractors and builders. Industrial electric trucks are attracting increasing interest and are expected to yield a good volume of sales during the coming year. The Boston & Albany Railroad has purchased five 500-watt locomotive headlight generators. Appliance sales in the district are running ahead of last year's record.

Sales in Good Volume in New York District—Utilities Active

MOTOR and general-supply sales in the New York district have been well distributed and are in good volume, though not consisting of any particularly large-sized orders. The demand for fractional-horsepower motors is said by a large manufacturer to be about 6 per cent better for the first six weeks of this year than for the same period in 1924. Statements on general business conditions vary from quiet to spotty and fairly good.

Many inquiries have been received by manufacturers from central-station companies for power-house equipment, switching equipment and power transformers, so that many sales of this apparatus are expected to be made this month.

The demand for pole-line hardware is good, one company reporting a large increase over sales last year for the same period and a rapidly developing export trade. Among orders placed is one for approximately $100,000 worth of apparatus for a power company in Georgia. This order includes transformers, synchronous converters, switchboard equipment, etc. A wire company reports that inquiries received in the last week cover about 10,000,000 lb. of copper wire, and another manufacturer says that he is now filling an order for $18,000 worth of switchboard instruments for one central-station company.

The outlook for export trade is said to be decidedly better. One company states that orders received since the first six weeks of this year are better than in any period in 1924. Jobbers report sales as a little quiet with the demand for radio apparatus also decreased. The general feeling is that a good spring business will be obtained. Commercial lighting fixtures are said to be moving in very good volume.

Central-Station Companies Continue Active in Southeast

CENTRAL-STATION expansion and improvements in the Southeast, especially in Florida, are calling for large quantities of poles, cross-arms and pole-line hardware. There is a strong tendency on the part of central-station companies to enter the merchandising field aggressively, several power companies having announced within the past two weeks their intention to do so, and appliances are selling well. An improvement has been noticed in electrical jobbing lines, but retail business in Atlanta is slow. There is some activity in the demand for clay conduit, and panelboards are selling in volume above the average.

The missionary work done by electric truck manufacturers during the past few years is beginning to bear fruit and several satisfactory sales are reported. The co-operation given by central-station companies is helping this line materially, and the outlook for the year is very bright. Sales of batteries for automobile and radio use are increasing steadily. An encouraging increase in the sale of truck and locomotive batteries is reported, with a considerable number of inquiries in hand. The demand for domestic electric refrigerating equipment is gaining steadily, and the merchandising of this specialty has been undertaken by some of the larger Southeastern power companies. There are prospects that other companies will take on the line during the year. Purchases by large contractors for industrial use are reported as having materially improved during the past ten days, but small contractors are still placing their orders sparingly and with considerable care.

Construction Work Results in Better Sales on Pacific Coast

MUCH postponed construction has been resumed on the Pacific Coast, and this has resulted in perceptibly better sales. The values of February, 1925, building permits were: San Francisco, $3,871,487; Los Angeles, $10,884,244; Oakland, $3,540,151. The values for the corresponding month last year were: San Francisco, $3,912,166; Los Angeles, $16,083,412; Oakland, $2,250,570.

Power companies have placed orders for 25,000 braces and 20,000 heavy bolts during the past week, and it is generally predicted that the month of March will produce much business from these companies. Railroad purchasing is heavy, including maintenance material for storm replacements and wiring as well as supplies, one order calling for 600 heavy portable guards and two carloads of iron tie wires. Fashion week in San Francisco has resulted in many orders for lighting equipment such as spotlight, color screens and daylight lamps for window displays. Many good orders for lighting fixtures for new buildings are being received. Appliance sales are better as a result of special efforts to improve the poor record of January, and several good inquiries for rural telephone systems have been received.

In the Northwest section of the Pacific Coast there has been a fair movement of used motors, but motor and generating equipment has been quiet with no immediate signs of improvement. Inquiries from lumber mills planning electrification of plants have not yet materialized into orders and are not liable to until the lumber market becomes stabilized. Logging operations are being cut down throughout the Northwest, and this should be the cause of putting the lumber business on a better footing.

Activities of the Trade

Hurley Machine Organizes Hurley Vacuum Cleaner Company

The Hurley Machine Company announces the organization of the Hurley Vacuum Cleaner Company. The new company will take over all of the parent company's vacuum-cleaner business and will have its main office on the eighteenth floor of the Steger Building, Chicago. E. N. Hurley, Jr., for many years vice-president of the Hurley Machine Company, has been elected president of the new company.

Crocker-Wheeler Company Reports Sales to Steel Mills

The Crocker-Wheeler Company, Ampere, N. J., reports increased buying activity on the part of steel mills. Among recent orders placed with the company is one from the Sharon Steel Hoop Company for three 2,000-kw., three-unit motor-generator sets for the Sharon (Pa.) plant, to be used for rolling-mill drives and auxiliary motors. Another order placed by the same company for its Youngstown (Ohio) plant, to be used for sheet-mill drives, is three 1,000-hp. inclosed, ventilated, coupled-type slip-ring motors. Another order for the same company's plant at Lowellville, Ohio, covers one 1,000-kw. synchronous motor-generator set.

The Central Furnace Company, a subsidiary of the Central Steel Company, Massillon, Ohio, has also placed an order with the company for thirteen direct-current type M-11 motors, aggregating about 1,400 hp. These motors will be used for the operation of an ore bridge and a car dumper for a new furnace to be built at Massillon.

Pettingell-Andrews Opens Maine Branch

A branch office and warehouse has been opened by the Pettingell-Andrews Company, electric supply jobbers, Boston, at 403 Fore Street, Portland, Me. The establishment occupies a three-story buliding and will be in charge of Neal White of the Maine sales staff of the company.

Tagliabue Manufacturing Company Extends Facilities

The C. J. Tagliabue Manufacturing Company, 18 Thirty-third Street, Brooklyn, N. Y., manufacturer of automatic controllers, oil-testing instruments, etc., announces that the demand for engineering service has compelled an expansion and the creation of new functional departments. Hereafter a separate department known as the engineering research department will be established under the head of Victor Wichum, who continues as chief engineer. The experimental department will be continued in charge of Frank Bast, and R. M. Wilhelm, formerly of the Bureau of Standards, will be in charge of the development of oil-testing instruments.

Some of the more important problems of the users of "TAG" instruments will be taken care of by Daniel C. Day under the general sales manager, Harvey D. Cooke. William C. Begeebing will be in charge of the division covering automatic controllers and dial indicating and recording thermometers.

The Meadows Manufacturing Company, Bloomington, Ill., manufacturer of electric washing machines, held its second annual sales conference at Bloomington, February 8 to 13. The conference was attended by representatives from almost every state in the Union and from Canada. H. L. Barker gave the opening address and M. B. Wheeler, who was recently appointed general sales manager, described the company's selling policy. John Rocke described the products, Fred Larison outlined the partial-payment plan, and Mr. Kling, advertising counsel, spoke on "making money for dealers." Charles H. McIntosh of Chicago discussed "Modern Salesmanship."

The Electric Products Company, Cleveland, manufacturer of "Wotton" motor-generators and switchboards for battery-charging and special applications, announces that Otis B. Duncan, Room 1062, 53 West Jackson Boulevard, Chicago, has been representing the company in that territory since March 1.

The Western Electric Company will shortly erect a two-story building at Chartres Street and Commerce Avenue, Houston, Tex., 100 ft. x 100 ft., to cost approximately $40,000. It will be used for local headquarters and to provide distributing service.

The Okonite Company, Passaic, N. J., manufacturer of insulated wires and cables, announces that in order best to serve the interests of its customers in the Middle West it has opened a sales office in St. Louis at 444 Frisco Building with L. R. Mann in charge.

The Strom Ball Bearing Manufacturing Company, 4527 Palmer Street, Chicago, announces that Arthur W. Weise has been appointed manager of the Philadelphia office of the company at 309 Lincoln Building.

The Gibb Welding Machines Company, formerly the Gibb Instrument Company, Bay City, Mich., manufacturer of electric welding equipment, announces the appointment of the Welding Service & Sales Company, Donovan Building, Detroit, as agent in the Detroit territory. T. M. Butler is manager of the Welding Service & Sales Company.

The Advance Machinery & Supply Company, Railroad Building, Denver, jobber and manufacturers' agent, announces that the city of Denver has placed an order with the company as Western representative of the De Laval Steam Turbine Company, Trenton, N. J., for one 15,000,000-gal. De Laval centrifugal pump driven through reduction gears by a De Laval steam turbine, together with condenser and auxiliaries complete. This is stated to be the fourth De Laval unit installed in the Denver waterworks system in the past two years.

The General Engineering & Supply Company, Mohawk Building, 160 Fifth Avenue, New York City, announces that it is now placing on the market the "Gesco" portable high-frequency machine for electrotherapeutic work. This instrument is intended for use in the hospital, the doctor's office or the home of the patient.

The Stow Manufacturing Company, Inc., Binghamton, N. Y., manufacturer of "Stow" flexible shafts and portable tools, announces that the Horne Company, Ltd., 36 Kawaguchi-Cho, Nishi-Ku, Osaka, Japan, with branches throughout that empire as well as in Korea, Formosa and Manchuria, has been appointed its agent and will carry a complete stock of material.

The Trico Fuse Manufacturing Company, Milwaukee, Wis., manufacturer of Trico powder-packed, time-limit renewable fuses, announces a new line of approved non-renewable cartridge fuses which is built in all standard sizes up to 600 amp. for both 250-volt and 600-volt service. The new line is known as the Trico "Kantark."

The S. Morgan Smith Company, York, Pa., has received an order for two 6,000-hp. vertical turbines from the United States Reclamation Service to be used in the Gem Irrigation District at the Black Canyon Dam on the Payette River near Emmett, Idaho.

The American Electric Company, St. Joseph, Mo., jobber, announces that G. C. Dyer, formerly with the Electric Appliance Company, Dallas, Tex., is now representing the company in central Missouri and eastern central Kansas.

The F. W. Wakefield Brass Company, Vermilion, Ohio, manufacturer of "Red Spot" hangers and other lighting specialties, announces a type of fixture which attaches to any ceiling fan and is said to give safe and rigid support to lamp and globe.

The Pittsburgh Transformer Company, Pittsburgh, has taken out a permit to build a one-story addition to its plant at Preble Avenue and Juniata Street, estimated to cost $30,000.

The Diamond Power Specialty Corporation, Detroit, manufacturer of "Diamond" soot blowers, has appointed Lynn W. Nones as eastern sales manager in charge of the Atlantic Coast offices from Boston to Charlotte, N. C., inclusive. Mr. Nones will be established at 90 West Street, New York.

Frederick Rall, 52 Warren Street, New York, manufacturers' agent, announces that his business has recently been incorporated under the name of the Frederick Rall Company, Inc., and that hereafter all business will be conducted under the incorporation name. The officers are Frederick Rall, president and treasurer; A. Autenrieth, vice-president; O. J. Fisher, second vice-president, and G. R. Browne, secretary.

The Riley Stoker Corporation, Worcester, Mass., has produced a motion picture which shows the functions of a stoker from the time the coal enters the hopper until it enters the ashpit. The company says that the

stoker pictured is the largest single-ended stoker yet built. This machine is able to burn more than 15 tons of coal per hour and at maximum rating requires about 3½ tons of air per minute to burn the coal. A coal-feeding scene, actual fire pictures and the operation of a clinker grinder are shown in the new motion picture.

The Combustion Engineering Corporation, Combustion Engineering Building, 25 Broad Street, New York, announces the appointment of W. R. Quinn, formerly manager of the fuel-oil department, as Pacific Coast agent. Temporary headquarters have been established at 1132 Shotwell Street, San Francisco.

New Equipment Available

Industrial Control

Three new types of starters for industrial control are now being marketed by the General Electric Company. These are an inclosed magnetic switch for starting two-phase and three-phase alternating-current motors and two types of automatic starters for synchronous motors, one for full-voltage starting and the other for reduced-voltage starting.

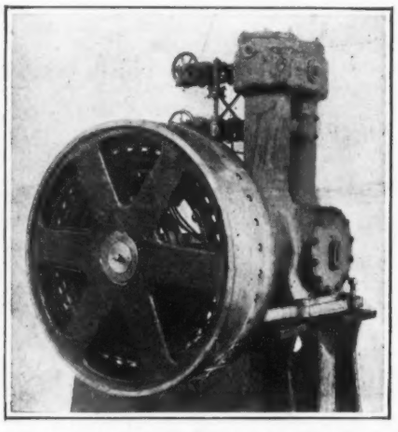
The inclosed magnetic switch bears the designation CR-7006-D9 and is for use with two-phase and three-phase alternating-current motors which can be thrown directly on the line in starting. This switch is also used to handle the primary circuit of a slip-ring motor in conjunction with a secondary drum switch. The CR-7006-D9 was developed for starting larger motors than can be handled by the CR-7005 and CR-7006 types of switch now on the market.

The new synchronous-motor starters are known as the CR-7065 and CR-7061, for full and reduced voltage starting respectively. Both starters are completely automatic. Special features are a temperature overload relay for close protection of the motor from overload, a definite time relay which determines the accelerating period during which the motor is connected to the compensator taps and a field-controlling relay for closing the field contactor. The CR-7065 starter is recommended for use with low-speed synchronous motors driving pumps and compressors and for other general applications. The CR-7061 starter is recommended for use with medium-speed and high-speed synchronous motors for driving pumps, motor-generators, etc.

Flywheel Type Synchronous Motor

A line of direct-connected, slow-speed synchronous motors of the "flywheel" type has been developed by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. The stator of the machine is mounted in a cradle support forming a part of the compressor or engine casting. The female fit of the cradle seat as well as the bearing housing is machined to gage at the same setting. To produce a true bore, and also to prevent any possible shifting of the stator in an upward direction, the cradle seat is extended somewhat above the half circle.

The rotating element is outside the stator. The rotor has a pulley fit on the shaft extension and is locked in place by a key. A hole drilled and tapped in the shaft extension serves two purposes: Under normal condition, a cap screw holds the locking plate in position, while if it is desired to remove the rotor a threaded stud is substituted for the cap screw and by some auxiliary means the rotor is easily removed. The normal flywheel effect of the motor is said to be 50 per cent in excess of that required with a compressor. Additional flywheel effect can easily be obtained, if desired, by using additional rim section. The construction of the rotor is such that all vital parts are inside and protected, and it looks much like an ordinary pulley. Its face is crowned so that an exciter or other auxiliary machine may be belted to it. The complete motor is self-contained and forms a part of the compressor.



30-HP., 200-R.P.M., 60-CYCLE "FLYWHEEL TYPE" SYNCHRONOUS MOTOR DIRECT-CONNECTED TO A 7½-IN. x 7½-IN. VERTICAL COMPRESSOR

Unit Coal Pulverizer

A unit pulverizer to meet the demands of the modern boiler plant has been developed by the Bonnot Company, Canton, Ohio. It is known as the "Bonnot Unit-Air ball mill." The "Unit-Air" pulverizer consists essentially of a feeder, a revolving cylinder in which a charge of grinding balls reduces the coal to the necessary fineness, an interior classifier, an exterior separator and an exhaust fan. The pulverized fuel is drawn through the interior classifier into the air separator, through the exhauster and thence to the combustion chamber.

The entire unit, except the exhauster, is mounted on a one-piece gray-iron bedplate. The speed reducer used is of the worm-and-gear type, is equipped with "Timken" roller bearings and all parts are inclosed. The grinding cylinder is made of gray iron, fitted with rolled-steel supporting tires and cut girt gear. The cylinder revolves on four alloy steel rollers which are mounted on "Timken" roller bearings. One of the features of the "Unit-Air" pulverizer is the interior classifier whose function is to collect by suction all the finished product when pulverized and carry it out of the mill through the discharge conduit to the air separator.

The fineness of coal fed into the combustion chamber is controlled by the adjustment of the clean air inlet to the perforated plate. The entire unit is lubricated with the "Alemite" system. The pulverizer is made in sizes ranging from 3,000 lb. to 16,000 lb. per hour.

Load Indicator for Transformers

A load-indicating device for distribution transformers which compensates for ambient temperature is a recent development of the General Electric Company. The device is known as the "type A Thermotel," Catalog No. 270,-503. This instrument consists fundamentally of two thermometers connected in series. The first thermometer is actuated by the heat of the transformer's top oil; the second, located in the external case, by the ambient temperature, modifying the reading of the first.

The composite reading given by the hand of a dial closely approximates the internal coil or hot-spot temperature and for convenience is given in terms of "per cent equivalent load." The dial is calibrated from 50 to 125 per cent equivalent load. A semaphore is tripped by the mechanism and swings into view when the instrument registers more than 100 per cent. A resetting lever extends below the external case, and upon being reset the instrument indicates the then existing load conditions on the transformer. The apparatus is said to be very easily installed, it being necessary only to remove the cover.

Traffic Signals

A new signal for denoting traffic direction has been placed on the market by the Essco Manufacturing Company, Peoria, Ill. This signal, known as the type K-4, is particularly suited to intersections of highway routes and for directing traffic in the vicinity of depots, wharves and public buildings. It is said that the illuminated handle can be seen under brightest sunlight as well as at night. The post and base of this unit are illuminated by means of special lenses in the bottom of the standard. No extra wiring or fixtures are required.

A traffic fire-stop signal has also been developed by the company for use in the vicinity of fire stations. The use of this signal is said to permit a safe and quick get-away of the fire-fighting apparatus.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Bordeaux, France, (No. 13,879), of electrical automobile equipment, household appliances, radio parts and sets and electric lighting plants for use in the country.

An agency is desired in Hurstville, Australia (No. 18,878), for small motor-driven buffers.

An agency is desired in Birmingham, England (No. 13,875), for electrical appliances and labor saving devices.

An agency is desired in Brussels, Belgium (No. 13,880), for electrical appliances and motors and electrical measuring apparatus.

Purchase and agency is desired in Macao, China (No. 13,911), for electric generating sets.

New Trade Literature

SWITCH HOUSES.—Bulletin No. 458 issued by the Condit Electrical Manufacturing Company, South Boston, Mass., covers the Condit switch houses for indoor and outdoor service. These switch houses may be equipped with practically all types of indoor switching apparatus, manually or electrically operated, and with or without metering equipment.

INSULATORS, INSULATOR FITTINGS, CLAMPS, ETC.—Locke Insulator Corporation, Baltimore, has issued catalog No. 25, covering the Locke suspension insulators, attachments, etc. The book is cloth-bound and contains 253 pages, well illustrated, describing the various types of its insulators, interconnecting hardware, bushings, tubes, connectors, etc. Tables are also included giving the physical properties of commercial wire, weights of various wires, ultimate strength of wire and cable, etc.

GROUND RODS.—The Copperweld Steel Company, Braddock Post Office, Rankin, Pa., is distributing a leaflet covering its Aristos "Copperweld" ground rods. It contains physical data on the ground rods and electrical data on driven grounds and also instructions for soldering solid grounding wires.

DISTRIBUTION TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, is distributing bulletin 200-A covering its complete line of distribution transformers. It contains a short sketch of the history of the company in the electrical industry and a description of coil and core construction. Illustrations are given showing various type and sizes of distribution and power transformers.

ELECTRIC HEATERS. — The Buffalo Forge Company, Buffalo, N. Y., is distributing a folder describing its "Breezo-Fin" electric heaters for heating shops, etc. Tables are given showing over-all dimensions and capacities of the heaters.

WIRING DEVICES.—The Circle F Manufacturing Company, 10 Prince Street, Trenton, N. J., is distributing a folder describing its "Circle F" wiring devices, including sockets, receptacles, plugs, current taps, etc.

COAL CRUSHER.—Bulletin No. 50 issued by the Pennsylvania Crusher Company, Stephen Girard Building, Philadelphia, describes and illustrates the "Pennsylvania Armorframe" for crushing coal for all types of mechanical stokers. The crusher is of unbreakable steel construction and is manufactured in capacities from 25 tons to 450 tons per hour.

THRUST BEARINGS. — The Kingsbury Machine Works, 4320 Tackawanna Street, Frankford, Philadelphia, has issued bulletin G, covering the "Kingsbury" thrust bearings, horizontal propeller types.

FLEXIBLE FIXTURE HANGINGS.—Bulletin No. 2,063 issued by the Crouse-Hinds Company, Syracuse, N. Y., covers its various types of flexible fixture hangers.

WELDLESS STEEL POLES. — Vielé, Blackwell & Buck, 49 Wall Street, New York City, United States representatives of the Mannesmann Röhren-Werke, is distributing bulletin No. 12 entitled "Weldless Steel Poles," covering the Mannesmann one-piece seamless tubular steel poles. These poles are manufactured by the Mannesmann's special process to any length, wall thickness and any desired diameter up to 12 in.

TESTING SETS.—Catalog No. 1,075, entitled "Megger' and 'Bridge-Megger' Testing Sets" has been issued by James G. Biddle, 1211-13 Arch Street, Philadelphia, describing the "Megger" testing sets. It contains an article on "Insulation and the Measurement of Its Resistance" and gives directions for using "Megger" testing sets, and for making various insulation resistance tests.

AIR FILTER.—The Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, is distributing a folder describing its type U2, new model, "Midwest" unit air filter for cleaning air.

HIGH-FREQUENCY APPARATUS.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, has issued bulletin No. 984, describing the "Vreeland" oscillator and other devices for producing high-frequency alternating current. Output curves are given showing the "Vreeland" sine-wave oscillator high-voltage secondary and low-voltage secondary. Bulletin No. 533 describes and illustrates the "Burrows" permeameter, which is designed for testing bar samples, and the "Epstein" core-loss apparatus, designed for measuring core loss in accordance with the A.S.T.M. test specifications.

COAL PULVERIZER. — The Bonnot Company, Canton, Ohio, is distributing Bulletin No. 64 describing the Bonnot "Unit-Air" ball mill for preparing pulverized coal for direct firing of boilers. It contains a short sketch of the development of the Unit-Air ball mill for boiler firing and explains the method of construction.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

READING, MASS. — Extensions and improvements to the municipal electric light plant, to cost about $80,000, are under consideration by the Board of Selectmen.

SPRINGDALE, CONN.—The Segal Metal Products Company is planning to install electric power equipment in connection with proposed extensions in its plant.

Middle Atlantic States

BREWSTER, N. Y.—A group of utilities in the territory extending from the northern end of Westchester County at Katonah and Bedford, and in Connecticut at Ridgefield northerly to Chatham in Rensselaer County, New York, has been acquired by interests affiliated with the Associated Gas & Electric Company, 61 Broadway, New York City. Application has been made to the Public Service Commission of New York by these properties, formerly consisting of twelve separate companies, looking to grouping all of them into one company, to be known as the Harlem Valley Electric Corporation, with headquarters at Brewster. Plans are now being prepared by the Associated engineers for the erection of high-tension transmission lines to connect the various properties.

BUFFALO, N. Y.—Bids will be received by the Superintendent of Lighthouses until March 16 for one 34-hp. engine-generator unit.

BUFFALO, N. Y.—The City Council is considering the installation of combination street-lighting and traffic signal standards on Main Street.

LEDYARD, N. Y.—The Ledyard Lighting Company, Inc., has been authorized to exercise franchises granted in the towns of Scipio, Venice and Genoa.

NEW YORK, N. Y. — The New York Edison Company has filed plans for the erection of a substation at 207 West Eighty-fourth Street, to cost about $186,000. William Whitehill, 709 Sixth Avenue, is architect.

NEW YORK, N. Y.—The American Can Company, 120 Broadway, is planning to install electric power equipment in connection with extensions and improvements to its plant in 1925, to cost about $5,000,000.

NEW YORK, N. Y.—Plans have been approved by the Public Service Commission for electrification of the Mount Morris branch and certain electric sidings in New York and Yonkers of the New York Central Railroad Company.

NIAGARA FALLS, N. Y. — The City Council is considering extensions to the ornamental lighting system throughout the city.

POUGHKEEPSIE, N. Y. — Application has been made to the Public Service Commission by the Central Hudson Company for permission to acquire the properties of the Citizen's Railroad, Light & Power Company, the Fishkill Electric Railway and the Southern Dutchess Gas & Electric Company, all of Beacon. It is proposed to merge the street railway properties into the Fishkill company and the gas and electric properties into the Central Hudson Company.

ROCHESTER, N. Y.—The Rochester Gas & Electric Company has petitioned the Public Service Commission for authority to extend its transmission lines through the town of Perintown and to exercise a franchise granted by the Town Board.

SCHUYLER, N. Y.—The Utica (N. Y.) Gas & Electric Company has been granted permission to exercise a franchise in the town of Schuyler.

UTICA, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until March 25 for electric elevator for main building at the Utica State Hospital.

WILLARD, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until March 25 for fire-alarm system, etc., for the Willard (N. Y.) State Hospital.

WINGDALE, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until March 18 for alterations to buildings A and B, mess hall, kitchen, central heating and lighting plant, etc., at the Harlem Valley State Hospital, Wingdale. S. W. Jones, Albany, is architect.

MADISON, N. J.—The Borough Council is considering improvements in the municipal lighting system, including the installation of transformers, etc. Electricity is purchased from the Central Jersey Light & Power Company.

MARGATE CITY, N. J.—Plans are under consideration by the city officials for the installation of a new street-lighting system for Ventnor Parkway and Atlantic Avenue, to be maintained by underground wires. Street-lighting service is furnished by the Atlantic City (N. J.) Electric Company. Margate City has not a post office.

NEWARK, N. J. — The Department of Public Works plans to install 1,000-cp. lamps, with underground conduits on Washington and High Streets and South Orange Avenue in the spring.

CHEAT HAVEN, PA.—The West Penn Power Company, Pittsburgh, Pa., plans to build a series of power dams on the Cheat River in this vicinity in connection with a hydro-electric power development.

COOPERSBURG, PA.—The Pennsylvania Power & Light Company, Allentown, plans to erect a transmission line from its new sub-station at Freemansburg to the sub-station at Coopersburg. Sixty-cycle equipment will be installed in the local station.

PHILADELPHIA, PA. — The Carlot Receivers' Association plans to install electric power equipment in its proposed cold-storage, refrigerating and terminal plant, to be located in the vicinity of the present Philadelphia Tidewater Terminal, to cost about $6,000,000. E. S. Woodward, 122 Dock Street, is chairman of committee, in charge of the project.

SHARON, PA.—The City Council is considering further extensions to the ornamental lighting system on River Street, to cost about $12,000. Lewis E. Burnside is city engineer.

SOUDERTON, PA. — The question of building a joint municipal electric plant is reported to be under consideration by the residents of Souderton, West Telford and Telford. The town of Souderton now operates a municipal electric plant.

STEELTON, PA. — The York Haven (Pa.) Water & Power Company, York Haven, has secured a franchise to erect a transmission line on a number of city streets. The company has also secured permission to erect transmission lines in Swatara and Lower Swatara Townships.

SMYRNA, DEL. — Extensions and improvements in the municipal electric power plant, including the installation of additional equipment, is under consideration.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company is considering the construction of a new sub-station on Forest Street.

FAIRMONT, W. VA.—The Monongahela-West Penn Public Service Company is planning to extend its high-tension lines from its plant at St. Marys to Pennsboro and Ellenboro to furnish electrical service in those towns.

North Central States

GRAND RAPIDS, MICH. — The Luce Furniture Company is planning to install electric power equipment in connection with the rebuilding of its plant recently damaged by fire with loss about $400,000.

KALAMAZOO, MICH.—A special election will be held on April 7, to approve plans for extensions and betterments to the municipal electric plant.

ST. LOUIS, MICH.—The Dow Chemical Company, Midland, Mich., is planning to build a power plant on the Pine River, near here.

CLEVELAND, OHIO. — Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 13 for high-pressure steam piping for the division of light and power.

CLEVELAND, OHIO. — Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 13 for furnishing and installing electrical equipment and for elevator equipment complete for the police headquarters building. Separate bids to be submitted for each item.

CLEVELAND, OHIO.—Plans are under consideration for improvements to the waterworks station, to cost about $400,000. The work will include rebuilding four triple-expansion engines, installation of four 700-hp. vertical water-tube boilers with underfeed stokers, forced-draft fans, coal and ashhandling equipment, water-softening equipment, power piping, main switchboard and electric valve control, gages, meters, etc. L. A. Quayle, City Hall, is engineer.

WASHINGTON, C. H., OHIO. — The system of the Washington Gas & Electric Company, which supplies electricity in Washington Court House, New Holland, Leesburg and a number of other communities in this vicinity, has been sold to the Dayton Power & Light Company. The local power house will be equipped to serve as an auxiliary power plant for the Dayton Company, which has been taken over by the Columbia Gas & Electric Company, Charleston, W. Va.

GUTHRIE, KY.—The Kentucky-Tennessee Light & Power Company, Bowling Green, is considering extensions and improvements, including the erection of additional transmission lines, to cost about $2,000,000.

RUSSELL, KY.—The Chesapeake & Ohio Railroad Company, Richmond, Va., contemplates the installation of electric power equipment at its proposed local car and locomotive shops, to cost about $1,000,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company plans to build an addition to its power station at Kentucky Avenue and West Street, to cost about $15,000.

RICHMOND, IND.—Plans have been prepared by D. C. Hess, manager of the municipal electric light and power plant for an underground distributing system for both light and power wires, covering an area of twenty-four blocks.

COLUMBIA, ILL.—Application has been filed with the Commerce Commission by the Illinois Power & Light Corporation, Chicago, for permission to erect a transmission from Columbia to Valmeyer.

PAYSON, ILL. — The Payson Electric Light & Power Company has applied to the Commerce Commission for permission to erect a transmission line from Payson to Nebo to supply electricity in the latter town.

WITT, ILL.—The Indiana & Illinois Coal Corporation, Chicago, plans to build a steam-operated electric power plant at its local mining properties, to cost about $100,000.

EAU CLAIRE, WIS.—The Council has approved plans for the installation of an ornamental lighting system on Galloway Street.

GILMAN, WIS. — The Northern States Power Company, Eau Claire, is considering extending its transmission line from Thorp to Gilman, a distance of 20 miles, to supply electricity in Gilman and intermediate points. Surveys will be made for the proposed line to determine the cost, which will be submitted to the voters at the spring election.

NEENAH, WIS.—Plans are being considered by the City Councils of Neenah and Menasha for installing electric lamps along the new Nicolet Boulevard, which is the dividing line between the two cities.

PORTAGE, WIS.—The Wisconsin Power & Light Company, Madison, plans to erect a transmission line from Portage to supply electricity to consumers on the shore of Lake Wisconsin.

PORT WING, WIS.—Surveys are being made by the Northern Wisconsin Hydro-Electric Power Company for a proposed transmission line from its Orienta Falls power plant to supply electricity in Drummond, Mason, Grandview, Pratt, Cable and other towns.

RACINE, WIS.—Extensions and improvements are contemplated by the Wisconsin Gas & Electric Company during 1925, involving an expenditure of about $2,000,000.

WABENO, WIS.—The Town Board has granted the Wisconsin Public Service Corporation permission to extend its lines into Wabeno to supply electricity to the Wabeno Lighting Company. The company plans to erect a 13,000-volt transmission line from its Caldron Falls hydro-electric plant to Wabeno, a distance of 25 miles. As soon as this line is completed the company proposes another extension to Laona, connecting with the lines of the Connor Lumber & Land Company, which supplies electric service there. Electric service will also be supplied to rural districts and towns along the route of the proposed line.

WITTENBERG, WIS. — Extension and improvements are contemplated by the Wittenberg Light & Power Company, including the installation of an additional waterwheel, generator, etc., at its Embarras station and also extensions to its transmission lines.

MAHNOMEN, MINN.—T. L. and D. R. Croswell of Brainerd, who recently purchased the electric plant at Winger, contemplate erecting a transmission line between Mahnomen and Winger.

MINNEAPOLIS, MINN. — Plans are under way by the Minnesota Masonic Home Corporation for the construction of a lodge and power house at the Masonic Home, Bloomington, to cost about $300,000. A. F. Pray, 300 Oneida Building, is in charge. Bertrand & Chamberlain, Northwestern Building, are architects.

KANSAS CITY, MO.—The Air Reduction Company, 342 Madison Avenue, New York, is planning to install electric power equipment in connection with a proposed local acetylene equipment plant, reported to cost about $250,000, for which a site has been acquired.

KIRKWOOD, MO.—Bonds to the amount of $30,000 have been authorized for improvements to the municipal electric light plant.

FARGO, N. D.—The City Council is considering the installation of an ornamental lighting system in the business district, using five-lamp cluster standards. The Union Light, Heat & Power Company furnishes the street-lighting service.

LEMMON, S. D.—Steps have been taken by the Chamber of Commerce for the installation of a new lighting system in the business district.

PLATTSMOUTH, NEB.—Plans are under way by the Iowa Service Company, Omaha, for the erection of a 66,000-volt transmission line from Plattsmouth to Malvern, connecting up with the recently completed line from Lincoln to Plattsmouth.

Southern States

BREVARD, N. C. — The Council has granted the Blue Ridge Power Company, Spartanburg, S. C., permission to furnish electricity here. The company plans to erect a transmission line from Hendersonville to Brevard.

CHARLOTTE, N. C.—The Nebel Knitting Company, Kingston Avenue, plans to build a steam-operated electric power plant in connection with a proposed local mill, to cost about $100,000.

RALEIGH, N. C.—Negotiations have been completed by the Yadkin River Power Company with the towns of Morven, N. C., and Chesterfield, Ruby, Mount Croghan and Pageland, all in South Carolina, whereby the company will erect a high-tension transmission line from its hydro-electric plant at Blewetts Falls, connecting up the above towns, and to build or reconstruct distribution systems within these towns.

WILMINGTON, N. C. — The Tidewater Power Company contemplates extending its transmission lines from Wilmington through Rocky Point, Burgaw and other towns to Mount Olive, where it will connect with the lines of the Carolina Power & Light Company, Raleigh.

McCORMICK, S. C.—The Town Council is considering a bond issue of $28,000 for the installation of an electric light and power system.

ATLANTA, GA.—The Southern Railway Company, Washington, D. C., plans to build a power plant, to cost about $110,000, in connection with its proposed local locomotive and car repair shops.

ATLANTA, GA.—The City Council has authorized plans for a power plant on the Chattahoochee River, to be used in connection with a proposed waterworks station. The entire project will cost about $2,500,000. Paul Norcross, Candler Building, is engineer.

BLUE RIDGE, GA.—The Toccoa Power Company, operated by the Tennessee Electric Company, Chattanooga, Tenn., is acquiring property on the Toccoa River, near Blue Ridge, for a proposed hydro-electric power development, to cost about $2,000,000, including transmission system.

COLEMAN, FLA. — The Florida Power Company, Ocala, plans to erect a 60,000-volt transmission line from Bushnell to Coleman, via Sumterville. A franchise has been secured.

DE SOTO, FLA.—The City Council is considering a bond issue of $50,000, part of the fund to be used for extensions to the light and power system.

MIAMI, FLA.—Extensions and improvements are contemplated by the Miami Light & Power Company, to cost about $3,000,000.

VERO, FLA.—A special election will be held on March 16 to vote on the proposal to issue $100,000 in bonds, part of the proceeds to be used for extensions and improvements to the municipal electric power plant.

BIRMINGHAM, ALA.—Plans are under way by interests connected with the Alabama Power Company looking to the extension of the hydro-electric service from the Alabama Power Company's system in southern Alabama to Pensacola and other cities in northern Florida. The erection of transmission lines is being considered to introduce hydro-electric service in the coast cities of Mississippi and Alabama. The company has recently acquired some properties in Mobile, Gulfport, Biloxi, Christian, Bay Saint Louis and elsewhere. The purchase of other electric companies is also contemplated.

FAIRHOPE, ALA.—The Baldwin County Electric Light & Power Company has secured permission to erect a transmission line from Fairhope to Point Clear, via Battles Wharf and Fish Village, to cost about $70,000.

ERWIN, TENN.—The Carolina, Clinchfield & Ohio Railway Company, Johnson City, plans to install electric power equipment in connection with the proposed locomotive and car shops, to cost about $500,000.

MILAN, TENN.—Bonds to the amount of $40,000 have been issued, part of the proceeds to be used for extensions and improvements in the municipal electric light and water plants.

ST. ELMO, TENN.—Plans for the proposed new oil refinery to be built by the Flower Lewis Oil Refining Company in St. Elmo, a suburb of Chattanooga, include a power plant.

ALGIERS, LA.—The Algiers Public Service Company, Inc., is considering extensions and improvements to its transmission lines and system. The company recently increased its capital from $500,000 to $750,000.

CHENEYVILLE, LA. — Bonds to the amount of $27,000 have been issued, the proceeds to be used for a municipal light and power system.

ADAIR, OKLA.—A franchise has been granted to the Public Service Company of Oklahoma, Vinita, to install and operate an electric light and power system in Adair.

BRAMAN, OKLA.—The City Council has authorized the erection of a transmission line from Blackwell, about 11 miles, to supply electricity for local service. H. E. Musson & Company, Grain Exchange Building, Oklahoma City, are engineers.

LEEDEY, OKLA.—Bonds to the amount of $25,000 have been voted for the installation of a distribution system and erection of a transmission line to Elk City.

MULHALL, OKLA.—The City Council plans to call an election to vote on the proposal to issue $23,000 in bonds for the erection of a transmission line to Guthrie, and a local distributing system. The Gantt-Baker Company, Inc., 1116 West Main Street, Oklahoma City, is consulting engineer.

PERRY, OKLA.—Bids will be received by Bruce R. Lucas, city clerk, until March 11 for one 300-hp. to 350-hp. Diesel oil engine, generator and switchboard, etc.

TONKAWA, OKLA.—Bonds to the amount of $90,000 have been authorized for extensions to the municipal electric light system and waterworks.

Pacific and Mountain States

ABERDEEN, WASH.—The City Council is considering the installation of an improved street-lighting system on a number of streets. No bids were received on recent call. C. S. Hunt is city engineer.

TACOMA, WASH.—The City Council is considering the installation of an improved lighting system on South Sheridan Street and also an ornamental lighting system on portions of M and Ferry Streets.

PORTLAND, ORE.—The City Council is considering a petition for the installation of an improved lighting system on Jersey and Philadelphia Streets.

SALEM, ORE.—The City Council is considering the installation of an ornamental lighting system on Superior and John Streets.

HEALDSBURG, CAL.—The Board of Town Trustees has authorized the installation of an ornamental lighting system on West, Center, Matheson and Powell Streets, using about forty-eight standards.

LODI, CAL.—Plans are under way to extend the municipal electric light and power service into the new district recently added to the city, at a cost of about $1,200.

LONG BEACH, CAL.—The Long Beach Boulevard Improvement Association has approved plans for the installation of an ornamental lighting system on Long Beach Boulevard requiring about fifty-seven standards.

MERCED, CAL.—The Yosemite Portland Cement Corporation plans to install electric power equipment in its proposed local mill, to cost about $1,000,000.

SALINAS, CAL.—The Coast Valleys Gas & Electric Company plans to construct a local substation, to cost about $200,000; also to build substations at Monterey, Soledad and Gonzales. The total cost is estimated at $870,000.

SAN BERNARDINO, CAL.—The City Council has authorized the installation of electric lamps on portions of Fourth Street and G Street, using concrete standards.

SAN FRANCISCO, CAL.—The Board of Supervisors has decided to make a temporary arrangement with the Pacific Gas & Electric Company or the Great Western Power Company to distribute electricity generated at the Hetch Hetchy power plant, which will be ready for delivery at the substation on San Francisco Bay April 1.

SANTA CRUZ, CAL.—The City council has approved the installation of an improved street-lighting system on Soquel Avenue. H. E. Godegast is city engineer.

SANTA ROSA, CAL.—The City Council is considering the installation of an improved lighting system on Santa Rosa Avenue, Fourth and Fifth Streets.

SANTA ROSA, CAL.—The Great Western Power Company plans to install four 667-kw. transformers in its local substation and to increase the primary line voltage from 23,000 to 40,000.

WESTWOOD, CAL.—The Red River Lumber Company has applied for permission to construct a hydro-electric power plant on Hat Creek, a tributary of the Pit River, Shasta County, to cost about $500,000, with transmission system.

LEWISTON, IDAHO.—The City Council is considering calling an election to vote on the proposal to issue $1,200,000 in bonds to construct a dam across the Clearwater River, 4 miles above the confluence of Clearwater and Snake Rivers, and also a hydro-electric plant.

MESA, ARIZ.—The Queen Creek Irrigation District plans to erect a transmission line in connection with a proposed irrigation project to cost about $125,000.

Canada

DUNCAN, B. C.—The electric committee has recommended to the City Council installation of an additional Diesel oil engine in the municipal power plant and extension of the transmission line into North Cowichan.

ST. JOHN, N. B.—The Canadian government has granted the New Brunswick Hydro-Electric Commission permission to proceed with the proposed hydro-electric project on the St. John River, including the construction of a dam above Grand Falls. Following the announcement of the government, the New Brunswick commission has applied to the International Joint Commission for approval of the project.

TIMMINS, ONT.—The Canadel Gold Mines, Ltd., plans to install electrically operated machinery at its local mines to replace the present oil-burning machinery and equipment.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 10, 1925)

1,525,949. ELECTRIC LIGHT DIMMING DEVICE; A. Papini, Philadelphia, Pa. App. filed May 15, 1923.

1,525,958. HEATING STOVE; W. Schultz, New York, N. Y. App. filed March 26, 1923. Radiator type; heat-radiating walls formed of sheet metal, and means provided for heating and circulating a current of air.

1,525,967. COMMUTATOR CONNECTION; J. M. Vogel, Adrian, Mich. App. filed Aug. 2, 1924. Manner of connecting the segment to the respective armature winding.

1,525,972. ELECTRIC SWITCH; C. J. Zigler and W. P. Holden, Chicago, Ill. App. filed April 18, 1921. Safety type.

1,525,975. FUSE ELEMENT; W. O. Besaw, Reedley, Cal. App. filed May 4, 1923. For insertion in a fuse socket in conjunction with a burnt out fuse plug.

1,525,985. INDICATING FILLING PLUG FOR STORAGE-BATTERY CELLS; F. A. Feldkamp, Newark, N. J. App. filed Feb. 14, 1921.

1,525,995. AUTOMATIC TELEPHONE SYSTEM; E. Jacobsen, Port Washington, N. Y. App. filed April 15, 1918.

1,525,996. COMPOSITION FOR COATING CAST-IRON WELDING ELECTRODES; J. Jeffery, Chico, Cal. App. filed Dec. 26, 1922.

1,525,998. ELECTRIC STEAM GENERATOR; F. T. Kaelin, Montreal, Quebec, Canada. App. filed Sept. 10, 1921.

1,526,002. ELECTRIC WATER HEATER; A. V. Livingston, New Haven, Conn. App. filed Feb. 2, 1922. Automatic.

1,526,014. METHOD OF CONTROLLING THE ELECTRIC GENERATION OF STEAM AND APPARATUS THEREFOR; A. N. Russell, B. A. Malkin and W. P. Muir, Lachine, Quebec, Canada. App. filed May 2, 1922.

1,526,023. INSULATED VENTILATING CONNECTOR; L. Steinberger, Brooklyn, N. Y. App. filed Oct. 12, 1918. High-voltage bushing.

1,526,027. PHASE-SELECTING RELAY; O. C. Traver, Schenectady, N. Y. App. filed Nov. 16, 1923. Protective device adapted for use in connection with power systems having line conductors subject to high-resistance grounds.

1,526,042. AUTOMATIC CURRENT-CONTROLLING ARRANGEMENT; F. S. Barnes, Rock Hill, S. C. App. filed Aug. 20, 1921. For "farm-type" electric light and power plants.

1,526,062. ELECTROPLATING-OUTFIT CASE; J. O. Golden, Portland, Ore. App. filed March 24, 1924. Portable.

1,526,063. METHOD OF AND APPARATUS FOR REMOVING THE INSULATION FROM ELECTRICAL CONDUCTORS; J. T. Griffin, Oak Park, Ill., and W. A. Timm, Berwyn, Ill. App. filed Dec. 16, 1920.

1,526,081. AUTOMATIC TELEPHONE SYSTEM; W. W. Owen, Elgin, Ill., and C. M. Candy, Chicago, Ill. App. filed July 25, 1918.

1,526,083. MOTOR SYSTEM; E. G. Parvin, Roselle, N. J. App. filed Feb. 17, 1923. For use in opening and closing the doors of passenger cars operating under the conditions prevailing in subway, elevated and urban rapid-transit systems.

1,526,099. ELECTRIC RELAY; C. S. Snavely, Pittsburgh, Pa. App. filed Oct. 24, 1923. Contact mechanism.

1,526,123. PORTABLE ELECTRICAL COOKING APPARATUS; W. S. Du Charme, Cleveland, Ohio. App. filed Oct. 20, 1923.

1,526,132. THERAPEUTIC CHAIR; M. C. Gller, Green Bay, Wis. App. filed Dec. 18, 1922.

1,526,139. ELECTRICAL RESISTANCE UNIT; L. O. Grondahl, Pittsburgh, Pa. App. filed Dec. 4, 1922. Having the characteristic of varying in resistance in response to changes in temperature.

1,526,162. METHOD AND MEANS FOR TESTING ELECTRIC CIRCUITS; W. A. McCollum, San Antonio, Tex. App. filed Dec. 22, 1920. As high-tension magneto armatures including condensers and primary and secondary windings.

1,526,163. RELAY; C. E. McCoy, Wilkinson, Pa. App. filed March 19, 1921. Electromagnetic type adapted to systems of railway signaling.

1,526,168. INSULATOR LINK; R. H. Marvin, East Liverpool, Ohio. App. filed April 13, 1921. Suspension type.

1,526,199. TRACTOR; E. C. Bellinger, Atlanta, Ga. App. filed May 9, 1923. Operated by an electric motor.

1,526,204. WATER HEATER; M. B. Campbell, Brewton, Ala. App. filed June 4, 1923. Domestic type.

1,526,208. STORAGE-BATTERY ASSEMBLY; W. L. Gill, San Bernardino, Cal. App. filed Jan. 18, 1923.

1,526,214. ALARM; O. Hunger and W. Espenhayn, Chemnitz, Germany. App. filed June 28, 1920. Applicable to indicating and measuring instruments of all kinds.

1,526,217. SYSTEM OF CONTROL; H. D. James, Edgewood Park, Pa., and E. M. Bouton, East Pittsburgh, Pa. App. filed Jan. 14, 1921. Employed in connection with thermostats or pressure regulators.

1,526,236. RELAY; W. Rosecrans, New York, N. Y. App. filed Nov. 12, 1921. For closed-circuit work.

1,526,286. COUPLING DEVICE FOR TRAIN TELEPHONE SYSTEMS; L. A. Hornburg, Omaha, Neb. App. filed Aug. 6, 1921.

1,526,308. SIMULTANEOUS SIGNALING AND RECEIVING SYSTEM; A. J. Kloneck, New York, N. Y. App. filed Nov. 28, 1916. Particularly for radio telephony and telegraphy, although the system may also be employed for wire or cable signaling.

(Issued Feb. 17, 1925)

1,526,311. WIRELESS TRANSMISSION SYSTEM; M. C. Batsel, Wilkinsburg, Pa. App. filed Jan. 25, 1921.

1,526,314. ELEVATOR CONTROL; E. M. Bouton, East Pittsburgh, Pa., and F. E. Lewis, Edgewood, Pa. App. filed Dec. 31, 1921.

1,526,321. BATTERY BOX; H. R. Dam, Jamaica, N. Y. App. filed July 8, 1922. For a plurality of cells.

1,526,326. STORAGE BATTERY; T. A. Edison, West Orange, N. J. App. filed March 12, 1924. Nickel-alkali type.

1,526,335. SECRECY TRANSMISSION SYSTEM; E. V. Griggs, East Orange, N. J. App. filed Nov. 25, 1922.

1,526,337. METHOD AND APPARATUS FOR MEASURING TIME INTERVALS; R. V. L. Hartley, East Orange, N. J. App. filed Nov. 11, 1919. Of very small duration.

1,526,338. HEATER UNIT; J. D. Haynsworth, St. Louis, Mo. App. filed Oct. 2, 1922. For drying printed sheets.

1,526,347. TRANSFORMER TANK; C. L. Knotts, Swissvale, Pa. App. filed Jan. 8, 1920. To permit removing terminal bushings without exposing coils.

1,526,348. TWO-PARTY SIGNALING SYSTEM; J. M. Labaugh, Jr., Paterson, N. J. App. filed Feb. 21, 1923.

1,526,352. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed Sept. 24, 1920. Reflector type.

1,526,366. GAS LIGHTER; C. L. Old, Gilroy, Cal. App. filed April 21, 1921.

1,526,368. OPERATING MECHANISM FOR ELECTRIC CONTROLLERS; H. Petersen, Milwaukee, Wis. App. filed Nov. 20, 1922.

1,526,369. ELECTRIC HEATER; E. O. Pollard, Buffalo, N. Y. App. filed Jan. 5, 1923. For dental vulcanizers.

1,526,371. REGULATING DEVICE; L. M. Potts, Highwood, N. J. App. filed Oct. 26, 1922. For controlling the speed of motor-driven elements.

1,526,379. TRACKLESS TROLLEY; W. Schaake, Pittsburgh, Pa. App. filed Nov. 9, 1921.

1,526,382. SYNCHRONOUS DYNAMO-ELECTRIC MACHINERY; J. Slepian, Pittsburgh, Pa. App. filed April 4, 119. For power-factor correction.

1,526,391. TESTING APPARATUS; E. S. Stewart, Ottawa, Ill. App. filed July 30, 1920. Can be used in the location of a pipe when hidden from view.

1,526,402. LOOP CIRCUITS FOR TELEGRAPH REPEATERS; E. F. Watson, Larchmont, N. Y. App. filed Feb. 27, 1924.

1,526,404. LIQUID RHEOSTAT; C. C. Whittaker, Pittsburgh, Pa. App. filed Oct. 18, 1920. Employed in motor-control systems.

1,526,408. CARRIER-WAVE RECEIVING SYSTEM; F. W. Young, Long Island City, N. Y. App. filed Aug. 24, 1921.

1,526,414. ARRANGEMENT OF VIBRATING APPARATUS FOR SOUND SIGNALING; A. du Bois-Reymond, Plon, Germany. App. filed Jan. 5, 1921.

1,526,424. DRY-BATTERY CELL; H. M. Koretzky, New York, N. Y. App. filed March 4, 1922.

1,526,431. ELECTRIC SADIRON; M. Murphy, Indianapolis, Ind. App. filed April 4, 1924.

1,526,453. STORAGE BATTERY; St. Louis, Mo. App. filed May 15, 1922. Lead-acid type.

1,526,464. MAGNETIC LAMP HOLDER; O. C. Dennis, Wilmette, Ill. App. filed June 18, 1921.

1,526,494. ANNUNCIATOR DROP; C. J. Henschel, Brooklyn, N. Y. App. filed April 12, 1920.

1,526,523, 1,526,524. HEATING, COOLING AND LIGHTING FIXTURE; W. A. Brown, Philadelphia, Pa., and E. A. Corbin, Jr., Swarthmore, Pa. App. filed Nov. 27, 1923. Combined fan, heating element and lighting unit.

1,526,538. RANGE FINDER; H. C. Ford, New York, N. Y. App. filed Dec. 1, 1915. Used on war vessels.

Financial and Corporate

Utility Stocks Advance

Traders Accumulate Issues That Appear to Have Been Neglected

DURING the week preceding the inaugural at Washington the market for power and light stocks became stronger than it had been in some time, but, notwithstanding that fact, the trading revealed a highly selective attitude. Traders were not disposed, in other words, to buy stocks blindly, but were pretty careful to pick issues that had not, in their opinion, participated in the rise heretofore as much as others. Among the utility stocks listed on the New York Stock Exchange, for example, special attention has been attracted of late to Virginia Railway & Power Company's stock, which, although until very recently it had held for weeks around 64, last week crossed 86. Likewise Columbia Gas & Electric Company's stock, which this year has sold as low as 45 and a fraction, on the big board last week rose sharply to 59. Standard Gas & Electric shares improved in position smartly. Smaller gains were made on the listed market by North American Company's stock and that of the American Water Works & Electric Company.

In the unlisted market for power and light stocks Southeastern Power & Light Company's stock, which heretofore has been sensitive to activities with regard to the Muscle Shoals bill, suddenly moved forward about six points to around 60. Adirondack Power & Light has been gaining ground steadily of late, having moved forward persistently from around 30, and last week established the best price in its history by selling above 40. It advanced five and a half points during the week. Northern Ontario Light & Power has been under accumulation at rising prices. Many of the leading stocks, such as Electric Bond & Share Securities Corporation, American Power & Light and Commonwealth, changed but little.

Annual Report of Northern Indiana Gas & Electric

Substantial increase of the business of the Northern Indiana Gas & Electric Company during 1924 is shown by the annual report of the company recently issued. The operating revenue of the company in 1924 totaled $8,105,950, compared with $7,624,883 in 1923, an increase of $481,066. Net income of the company totaled $1,893,177 for the year, compared with $1,354,429 in 1923, an increase of $538,748. There was a material increase in the number of customers in the thirty-six communities served by the company, and sales of both gas and electricity showed a good increase over the preceding year. New electric customers added during the year totaled 4,793, making a total of 37,809 customers receiving electric service at the end of the year. Sales of electricity in 1924 totaled 129,725,449 kw.-hr., compared with 124,771,986 kw.-hr. in 1923.

One of the important developments of the year was the interconnection of the company's electric transmission and distribution systems with the superpower development in and around Chicago through the 132,000-volt transmission line of the Calumet Power Company, which extends from the Indiana-Illinois state line to Aetna, Ind., near Gary, a distance of 16 miles. Arrangements were made for the operation of this line and a large substation at Aetna by the Northern Indiana Gas & Electric Company.

The company's balance sheet shows that its total assets at the close of the year amounted to $41,021,655, compared with $36,589,847 on December 31, 1923.

Fitkin Interests Organize Holding Company

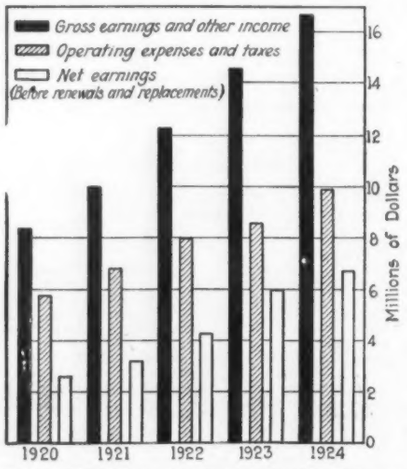
The National Public Service Corporation has been organized by A. E. Fitkin & Company, public utility operators and managers, New York, as a holding company for their combined public utility interests. The formation of this corporation is preparatory to bringing all of the Fitkin properties operating in eight states under one head. It was announced that financing totaling approximately $30,000,000 will follow the completion of the organization. The application filed last week with the New Jersey Board of Public Utility Commissioners, as announced in the ELECTRICAL WORLD, to merge several of the Fitkin properties in New Jersey into one operating company, was the first step taken to consolidate all the Fitkin utility interests.

Pennsylvania Power & Light Growth

This Eastern Utility, Consolidated Under Electric Bond & Share Supervision Five Years Ago, Already Has Doubled Its Business

BY PAUL WILLARD GARRETT

INCORPORATED on June 4, 1920, through the consolidation and merger of several companies operating in eastern Pennsylvania, the Pennsylvania Power & Light Company in a relatively short time has become one of the country's more important operating power and light properties. From the standpoints of gross revenue and invested capital it is, if not the largest operating company, one of the largest now under the supervision of the Electric Bond & Share Company. That organization undertook the difficult task some years ago of piecing together the numerous independent units which form a unified system doing, under control of the Lehigh Power Securities Company, a gross business of $16,641,359.



GROSS EARNINGS OF PENNSYLVANIA POWER & LIGHT SHOW STEADY YEARLY GAINS

To this new high total of gross earnings for 1924, $16,641,359, the Pennsylvania Power & Light Company has risen by steady yearly gains from $8,424,469 in 1920, the year of organization. The business of the company as measured by gross earnings thus has just about doubled within five years. In the same period the number of customers by steady yearly gains has increased from 64,332 to 140,111, and the kilowatt-hour output, also by persistent yearly increases, has risen from 411,640,000 to 630,923,335.

As a result of plowing large sums back into the property for a considerable period and the introduction of operating economies, the company, during the period that gross earnings have doubled, has been able to show net earnings (before renewals and replacements) even more impressive than gross. Again by steady yearly gains, net earnings grew from $2,611,129 in 1920 to $6,714,541 in 1924.

Additions to facilities and properties that have swelled the company's gross volume of business have required, of course, substantial increases in the funded debt, but fixed charges have been kept well in hand. While net earnings available for fixed charges have increased about 150 per cent during the four-year period under discussion, interest charges have been increased less than 100 per cent. The significance of these ratios is not appre-

ciated until it is realized that the 100 per cent increase in charges includes requirements on an eight-million-dollar offering of bonds recently made and the benefits of which have not yet been reflected in larger earnings.

The company's margins of safety for investors have been widening a little each year until now the bonds command a high investment rating and are popular with our conservative institutions. On completion of the present financing the company's annual interest charges will be $2,428,116, a figure that compares with net earnings available for such purposes in 1924 of $6,714,541.

Altogether the company has $43,583,100 of bonds outstanding, $16,583,100 being underlying closed-mortgage bonds and the remainder different series of first and refunding mortgage bonds. The latter are a first mortgage upon a substantial part of the company fixed property and a lien on the remainder subject to underlying bonds. While the generating capacity of the company's plants has been increased from 83,650 kw. early in 1921 to 153,400 kw. at present, work has been started on a new hydro-electric plant that will have an initial capacity of 40,000 kw. This property will add materially to the value of the property under mortgage.

The no-par-value preferred and common stocks on December 31, 1924, were carried on the company's books at $26,021,169, representing a large equity back of the bonds. The company has been unusually successful in its customer-ownership campaigns, having sold $12,900,000 of preferred stock in that manner since organization.

Dividends Declared

The following quarterly dividends were declared during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Central Illinois Public Service, pf.	$1.50	Apr. 15
General Gas & Electric, pf. A	2	Apr. 1
General Gas & Electric, pf. B	1¾	Apr. 1
Grafton County Elec. Lt. & Pwr., pf.	2	Mar. 2
Mississippi River Power, pf.	1½	Apr. 1
Montana Power, com.	1	Apr. 1
Montana Power, pf.	1¾	Apr. 1
Northwestern Public Service, pf.	1¾	Mar. 1
Pennsylvania Water & Power	2	Apr. 1
Public Service Co. of Oklahoma, com	2	Apr. 1
Pub. Serv. Co. of Oklahoma, pr. lien	1¾	Apr. 1
Pub. Serv. Co. of Oklahoma, pf.	1¾	Apr. 1
Tennessee Electric Power, 6% pf.	1½	Apr. 1
Tennessee Electric Power, 7% pf.	1¾	Apr. 1
Electric Controller & Mfg., com.*	$3	Feb. 28
Worthington Pump & Mchy., pf. A	1¾	Apr. 1
Worthington Pump & Mchy., pf. B	1¾	Apr. 1

*Extra

Narragansett Electric to Expand.—An act authorizing the Narragansett Electric Lighting Company to increase its capitalization from $20,000,000 to $30,000,000 was recently introduced into the Rhode Island House of Representatives and referred to the committee on corporations for action. The funds will be devoted to future expansion.

Radio Corporation Reports Record Earnings.—The report of earnings of the Radio Corporation of America during 1924 shows gross income from operations of $54,848,131 as compared with $26,394,790 in the previous year and $14,830,857 in 1922. The net income amounted to $9,503,442 as against $4,737,774 per 1923, an increase of approximately 100 per cent.

Company Reports

The following reports were issued during the past week for the month of January:

Name of Company	Gross Revenues for January 1925	1924
Alabama Power	$842,648	$756,533
Commonwealth Power	3,049,377	2,998,112
Georgia Railway & Power	1,514,569	1,439,486
Philadelphia Company	6,263,100	5,662,369
Republic Railway & Light	1,067,454	961,139
Tennessee Electric Power	907,609	797,877
United Gas & Electric	1,313,070	1,181,233
Washington Water Power	483,715	472,461
York Utilities	17,823	20,060

Record Light and Power Financing

ELECTRIC light and power companies were during the month of February responsible for nearly all of new issues of utility stocks, bonds and notes offered the investing public which totaled $140,625,000, the highest monthly total ever recorded. The Consolidated Gas Company and its subsidiary, the New York Edison Company, contributed $80,000,000 to this amount, the former with a fifty-million-dollar-issue of gold debenture bonds and the latter with a thirty-million-dollar-issue of first lien and refunding mortgage gold bonds. Of the $50,000,000, however, an unsegregated portion was for gas extensions. The average yield was 5.51 per cent.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN FEBRUARY

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Kansas City Pr. & Light Co. (Mo.)	$2,000,000	27	First mortgage gold bonds, series A	To reimburse for cost of additions and improvements	5	97	5.20
Electric Investors, Inc. (Me.)	4,320,000	...	Common stock	To provide additional working capital	..	48	....
Consolidated Gas Co. of New York	50,000,000	20	Gold debenture bonds	To reimburse for expenditures for extensions and additions	5½	100	5.50
New York Edison Co.	30,000,000	19	First lien and refunding mortgage gold bonds, series B	To repay temporary obligations and to reimburse for large capital expenditures	5	100	5
				Additions and improvements	6	100	6
Puget Sound Pr. & Light Co. (Wash.)	3,000,000	5	Gold coupon notes	To reimburse company for expenditures made and for other corporate purposes	5	97½	5.28
Texas Power & Light Co.	2,000,000	12	First mortgage gold bonds	Additions and for general corporate purposes	6	91½	6.55
Southwestern Pwr. & Lt. Co. (N.Y.)	2,000,000	97	Gold debenture bonds, series A	To reimburse for expenditures heretofore made and for general corporate purposes	6	97	6.15
American Gas & Elec. Co. (N. Y.)	9,000,000	89	Gold debenture bonds	To reimburse company for expenditures, for additions and for other corporate purposes	5	98½	5.11
Nebraska Power Co.	2,000,000	24	First mortgage gold bonds, series A	Construction	5	95½	5.30
Indiana & Michigan Electric Co.	8,000,000	30	First and refunding mortgage gold bonds	To retire unsecured indebtedness incurred for construction	5½	96	5.80
Lockhart Power Co. (S. C.)	1,500,000	25	First mortgage sinking-fund gold bonds	To reimburse company in part for capital expenditures, to defray cost of additions and for other corporate purposes	5	95½	5.30
					6	98	6.20
Pennsylvania Power & Light Co.	8,000,000	28	First and refunding mortgage gold bonds, series D	Acquisition of property and construction	7	96	7.30
Western United Corporation (Ill.)	1,530,000	15	Collateral gold notes	To reimburse for capital expenditures made and to be made	5½	97½	5.75
Southern Power & Light Co. (Md.)	1,440,000	...	Cumulative participating preferred stock	Expansion	6	97½	6.25
Great Western Power Co. (Cal.)	1,500,000	30	First and refunding sinking-fund gold bonds, series D	To reimburse for additions to property and on account of underlying bonds retired through sinking funds	5½	98	5.64
Michigan Electric Power Co.	585,000	19	First and refunding mortgage gold bonds, series A	Construction and additions and extensions	5½	97	5.75
Philadelphia Suburban Gas & Electric Co.	2,100,000	30	First and consolidated mortgage gold bonds	To pay indebtedness incurred in purchase of interest in American Light & Traction Company	5½	99	5.80
					7	95	7.37
Sioux City Gas & Electric Co. (Ia.)	2,300,000	25	First mortgage gold bonds, series C		6	97½	6.30
United Light & Power Co. (Md.)	5,000,000	3	Gold notes				
General Gas & Elec. Corp. (N. Y.)	1,900,000	...	Cumulative preferred stock, class B	Additions	6½	99	6.60
Southwestern Light & Power Co.	2,100,000	12	First mortgage and collateral lien gold bonds, series A				
Gatineau River Pwr. Co., Ltd. (Que.)	350,000	15	First mortgage sinking-fund gold bonds				
Total	$140,625,000						

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

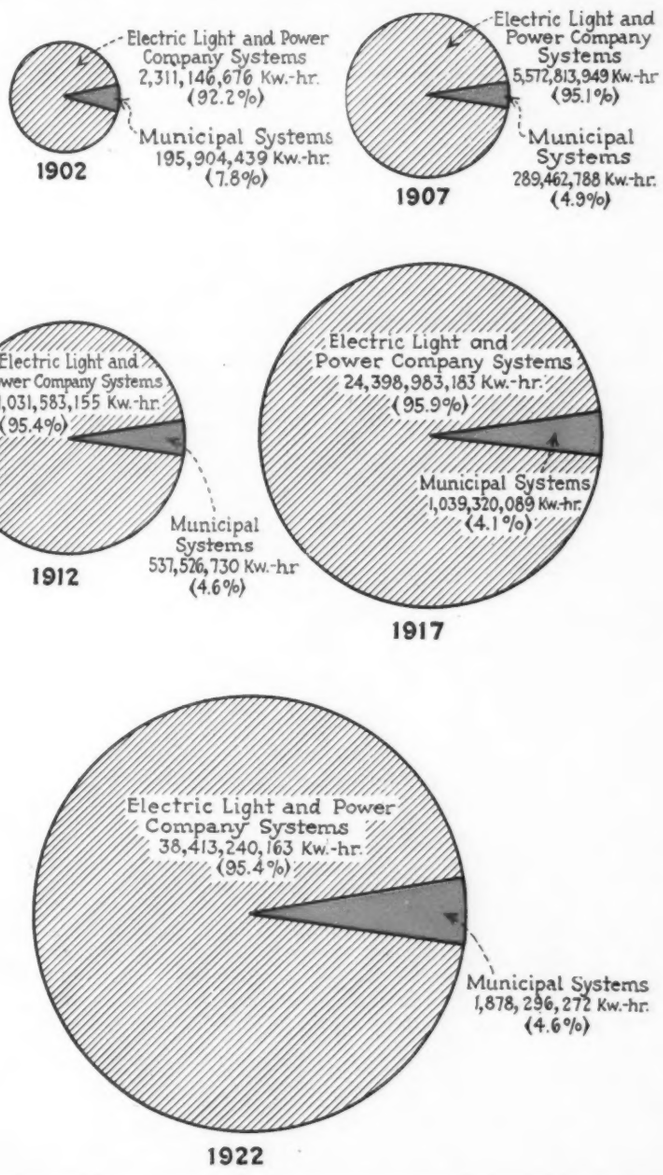
Companies	Bid Price Saturday, Feb. 28	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	101
Appalachian Power, 7 per cent	97	92	100
Arkansas Light & Power 7 per cent	94	92	98
Asheville Power & Light 7 per cent	a 99	99	100
Central Illinois Public Service 6 per cent	84½	84	87
Colorado Power 7 per cent	93	93	98
Connecticut Light & Power 7 per cent	105	105	110
Consumers' Power 6 per cent	91	90	93
Dayton Power & Light 6 per cent	94	88	100
Duquesne Light 7 per cent	a106½	105	107¼
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101	100	102
Great Western Power 7 per cent	96½	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	94	92½	98
Kansas Gas & Electric 7 per cent	a 98	98	100
Long Island Lighting 7 per cent	101	100	105
Minnesota Power & Light 7 per cent	a 96	96	98
Mississippi River Power 6 per cent	89	87½	91
Nebraska Power 7 per cent	a 98	98	100
Niagara Falls Power 7 per cent—25	28	28	29
Niagara, Lockport & Ont. Power 7 per cent	106	101½	110
Northern States Power 7 per cent	97	95	99
Ohio Public Service 7 per cent	97½	97	100
Pacific Gas & Electric 6 per cent	95	92	97
Pacific Power & Light 7 per cent	a 98	98	100
Penn-Ohio Power & Light 7 per cent	92	91	97
Pennsylvania Power & Light $7—no par	a101½	101	102
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	44	40	45
Southern California Edison 8 per cent	116	115	120
Tennessee Electric Power, 6 per cent	82	80	84
Texas Power & Light 7 per cent	a 99½	99½	101
Utah Power & Light 7 per cent	a 99	98½	99¾
Western States Gas & Electric 7 per cent	82	82	85
Yadkin River Power, 7 per cent	a 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—50	45	45	47½
American Light & Traction	93½	93	95½
American Power & Light 6 per cent	87½	86	90
American Public Service 7 per cent	87	87	92
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	102	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 50	...	...
Carolina Power & Light 7 per cent	101	100	105
Central Indiana Power 7 per cent	88½	88	93
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	80½	80	82½
Consolidated Gas 6 per cent—50	57½	57½	58½
Continental Gas & Electric 7 per cent pr. pf.	91	89	95
Electric Bond & Share 6 per cent	102	102	103½
General Gas & Electric—$8—no par	107	104½	110
*Middle West Utilities 7 per cent	94	91½	94¾
National Power & Light—$7—no par	96	95	99
North American 6 per cent—50	a 48½	46½	48¾
Public Service Corp. of N. J. 7 per cent	101	99	102
Public Service Corp. of N. J. 8 per cent	a112	110	112½
§Standard Gas & Electric 8 per cent—50	a 53½	53	53¾
‡United Gas Improvement—50	a 57½	57	58
United Light & Power—$6.50—no par	85	83	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	35	31	38
Appalachian Power—no par	76	70	83
Arkansas Light & Power	75	65	85
Brooklyn Edison	a128	120½	133
Buffalo General Electric	235	197	245
Colorado Power	a 33	...	...
*Commonwealth Edison	137½	134½	139
§Consolidated Gas, Electric Light & Power	a 35	32	35½
Dayton Power & Light	400	180	460
Detroit Edison	a115	110	115¾
|| Edison Electric Illuminating of Boston	201½	200	206
Kentucky Hydro-Electric	90½	85½	92½
Long Island Lighting	250	...	...
Mississippi River Power	37	37	40
Montana Power	68½	67½	72
Niagara Falls Power—no par	46	43	48
Niagara, Lockport & Ontario Power—no par	70	63	73
Northern Ohio Power	6½	5	7½
Northern States Power	104	103	107
North Texas Electric	62	62	67
Pacific Gas & Electric	106½	102½	108½
Penn Central Light & Power—no par	64	60	64
§Pennsylvania Water & Power	131½	126½	133½
‡Philadelphia Electric—25	44½	40½	45¾
Public Service Co. of Northern Illinois	97	97	100
Puget Sound Power & Light	52	51	58
Southern California Edison	103	102	106
Tennessee Electric Power—no par	52	47	61
Virginia Power	65	65	92
Virginia Railway & Power	a 85½	64½	86½
West Penn. Co.	a108½	105	120
Holding Companies			
American Gas & Electric—no par	73	72	80
American Light & Traction	148½	139	153
American Power & Light	54	54	67
American Public Utilities	75	75	85
American Water Works & Electric	a 38¾	34¾	39¾
Carolina Power & Light—no par	290	290	335
Cities Service	205	172	210
Columbia Gas & Electric—no par	a 58¾	45¾	58¾
Commonwealth Power Corp.—no par	113	106	126
Consolidated Gas—no par	a 76¾	74¾	78¾
Continental Gas & Electric	84	80	88
Federal Light and Traction	a137½	114½	140
General Gas & Electric	73	72	81
Lehigh Power Securities—no par	97	82	116
*Middle West Utilities—no par	88	82½	90½
National Power & Light—no par	196	185	230
North American—10	a 48½	41½	48¾
Philadelphia Co.—50	a 55½	52½	57½
Power Securities—no par	19	...	...
Public Service Corp. of N. J.—no par	a 70½	67½	72
Standard Gas & Electric—no par	a 47¾	40¾	47¾
United Gas & Electric (Conn.)—no par	30	26	37½
Utah Securities	a 54½	41½	54½
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	104½	102½	105
Alabama Power 5s 1946	97	96	97½
Appalachian Power 5s 1941	97	96	97½
Brooklyn Edison 5s 1949	99½	99½	100
Cleveland Electric Illuminating 6s 1930	104½	104½	105
Commonwealth Edison 5s 1939	100½	100	101½
Commonwealth Edison 5s 1943	100	99½	100½
Consol. Gas, Elec. Lt. & Pwr. 5s 1953	99	98½	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	97	95½	97
Consumers' Power 6s 1949	106½	104½	106½
Consumers' Power 5s 1936	99	99	99½
Consumers' Power 5s 1952	93½	90½	95½
Detroit Edison 5s 1933	101½	100	102½
Duquesne Light 6s 1949	105½	105	106½
Great Western Power 5s 1946	96½	95	97½
Kansas City Power & Light 5s 1952	96½	95½	97½
Mississippi River Power 5s 1951	97½	96½	97½
Montana Power 5s 1943	99½	97½	99½
New England Power 5s 1951	100½	100½	101½
New York Edison 6½s 1941	114½	112½	115
Niagara Falls Power 6s 1950	106½	105	106½
Northern States Power 5s 1941	96½	93	96½
Northern States Power 6s 1941	105	103	105½
Ohio Power 7s 1951	106½	106½	107½
Pacific Gas & Electric 5s 1942	95½	93½	96
Pennsylvania Water & Power 5s 1940	100	99½	100½
‡Philadelphia Electric 5s 1966	101	100½	102
5½s 1947	104½	103½	105
6s 1941	107	106	107
Portland Electric Power 6s 1947	99	94	99½
Southern California Edison 5s 1939	99½	99½	100
6s 1944	103½	102½	104½
Tennessee Electric Power 6s 1947	102	99½	102
Texas Power & Light 5s 1937	97½	97	98
Toledo Edison 7s 1941	110	108½	110
Utah Power & Light 5s 1944	94	91	95
Holding Companies			
Alabama Traction, Light & Power 5s 1962	85	85	87½
American Gas & Electric 6s 2014	96½	96½	97
American Power & Light 6s 2016	95	94	95½
Amer. Water Works & Electric 5s 1934	96	92½	96½
Associated Gas & Electric 6½s 1954	a 98½	...	...
Central Indiana Power 6s 1947	98	95½	98½
Commonwealth Power 6s 1947	100½	97½	101
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	79½	75½	80
Illinois Power & Light 6s 1953	101	100½	101½
United Light & Railways 5s 1932	95	93½	95
6s 1952	97½	95¾	97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	105	103½	107
*National Carbon	120	120	124
Worthington Pump & Machinery A	a 86½	85	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 78½	71½	82½
American Bosch Magneto—no par	a 40½	33	54½
Electric Storage Battery—no par	a 67½	62¾	70½
General Electric	a251½	227¼	320
General Electric—10	a 11½	11	11½
*Hurley Machine—no par	48½	47	56
†Wagner Electric	39	26½	50
Westinghouse Electric & Manufacturing—50	a 74	69¾	84
Worthington Pump & Machinery	a 73¼	62¼	79½
BONDS			
Canadian General Electric 6s 1942	107½	107½	107¾
General Electric 3½s 1942	82½	82½	84
5s 1952	102½	101½	105½
Robbins & Myers 7s 1952	70	67	73½
Western Electric 5s 1944	98¼	98¼	99½
Westinghouse Electric & Mfg. 7s 1931	108	107¼	108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, March 3.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Energy Generated by Municipal Plants Is Less than 5 per Cent of the Total for the Country



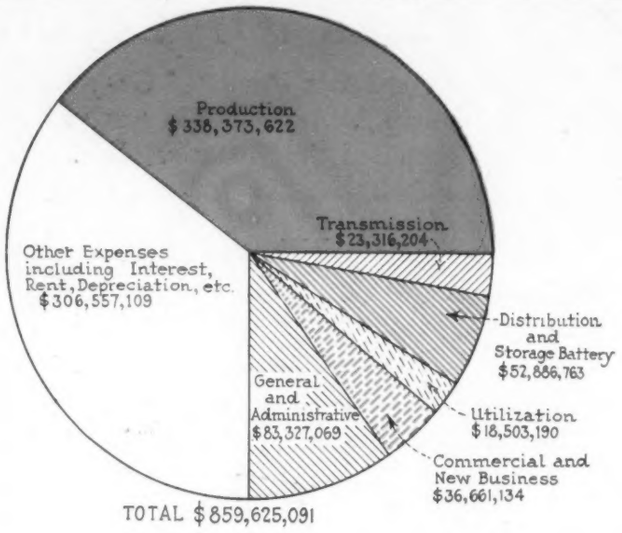
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

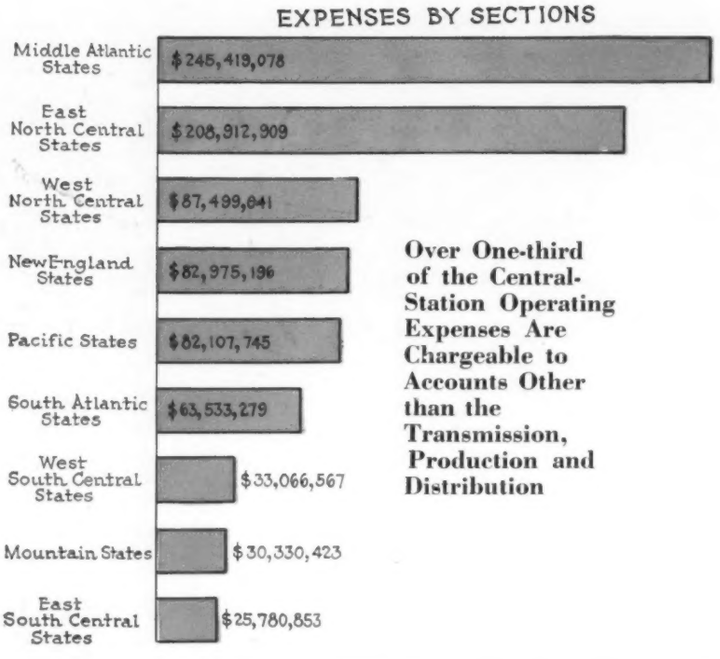
Actual Activities of the Municipal Systems Is Small

IN THIS world of practical accomplishments it is always the individual who actually brings to a fulfillment the great activities of life to whom the palm of leadership is extended. Those who make a loud noise, perhaps on account of their number, and yet whose contributions to the uplift of mankind are comparatively small, by the law of the survival of the fittest naturally play only a minor part in the great drama of life.

The same analogy holds true in the world of industry, and especially so as regards the two types of central-station control—private and municipal. There are 2,581 municipal systems operating in the United States against 3,774 electric light and power company systems. Offhand the inference to be drawn is that the municipal systems while slightly in the minority yet are a force which exert a very large influence in the councils of the electric light and power industry. But when the further fact is disclosed that the combined output of these municipal plants is only 4.6 per cent of the total, and that when the output of the four largest systems is deducted the output of the remaining 2,577 municipal systems is only 3.0 per cent of the country's electrical production, then the real place of the municipal systems in the counsels of the industry is ascertained. In other words, after deducting the output of the four outstanding municipal plants of the country, the average daily amount of energy generated by all the remaining 2,577 municipal plants is only 3,350,000 kw.-hr. or less than half the average daily output of the Commonwealth Edison Company of Chicago.

Truly must we study our basic information very carefully before accepting it at its face value as representing any condition within the industry.





Distribution of Central-Station Expenses

TO THE lay mind the fact that electrical energy must be sold at several times the actual cost of production is inconsistent. To him it looks like gross mismanagement on the part of the operating companies, and the bare fact furnishes fuel to the propagandist for municipal operations. But to the one who has made a study of the industry the answer is plain.

Not only is from ten to thirty per cent of the energy generated lost in transmission depending on the distance which the energy must be transmitted, but the actual cost of producing the energy is only about one third of the total operating expenses. Few take into consideration the fact that to extend its lines to meet the immediate needs of the community the central station must borrow large sums of money, the interest on which eats very materially into the gross revenue of the company.

The average central station must invest approximately six dollars for every dollar of gross revenue received. In practically every other line of business the volume of business done is many times the investment. It is to pay interest on this large investment that calls for such a large portion of the industry's revenue.

Large amounts must also be set aside for depreciation, sinking fund, rent and taxes. In fact the expenses of the central-station industry which have nothing at all to do with the generation transmission and distribution of energy aggregate over one-third the total expenses of the industry.